4.6 Central Facilities Area

The Central Facilities Area (CFA) is located in the south-central portion of the INL and has been used since 1949 to house many support services for all of the operations at the INL, including laboratories, security operations, fire protection, a medical facility, communication systems, warehouses, a cafeteria, vehicle and equipment pools, and the bus system (see Figure 4-35). CFA was designated WAG 4 in the FFA/CO.

Remedial actions for CFA CERCLA sites were evaluated in the *Remedial Investigation/Feasibility Study for Operable Unit 4-12: Central Facilities Area Landfills I, II, and III at the Idaho National Engineering Laboratory* (Keck et al. 1995) and in the *Comprehensive Remedial Investigation/Feasibility Study for the Central Facilities Area Operable Unit 4-13 at the Idaho National Engineering and Environmental Laboratory* (hereinafter referred to as the OU 4-13 RI/FS) (DOE-ID 2000a). Three CERCLA RODs issued in 1992, 1995, and 2000 addressed 52 release sites. Sites investigated at CFA include landfills, spills, ponds, storage tanks, dry wells, a sewage treatment plant, and buildings and structures. All sites are addressed in the *Final Comprehensive Record of Decision for Central Facilities Area Operable Unit 4-13* (hereinafter referred to as the OU 4-13 ROD) (DOE-ID 2000b).

Figure 4-35. Aerial view of the Central Facilities Area.

4.6.1 Current State

A current state map showing CFA is included as Figure 4-36. The final site at CFA that required remedial action, the Disposal Pond (CFA-04), was remediated in the fall of 2003. There are six sites at CFA that require institutional controls because of residual contamination—three closed landfills (CFA-01, CFA-02, and CFA-03), the CFA Disposal Pond (CFA-04), the CFA French Drains (CFA-07), and the CFA Sewage Treatment Plant Drainfield (CFA-08). Each of these sites is briefly discussed below. A current state conceptual site model for CFA from the OU 4-13 ROD (DOE-ID 2000b) is included as Figure 4-37.

The CFA-04 Disposal Pond was used from approximately 1953 to 1969 to collect run-off from CFA and to dispose of laboratory waste. Mercury and radionuclides from research activities were contained in the wastewater discharges. Simulated calcine, a dry granular material contaminated with mercury, was dumped at the edge of the pond and subsequently dispersed by wind, contaminating soil north of the Disposal Pond. The selected alternative for the Disposal Pond was excavation, treatment by stabilization with Portland cement, and disposal in the ICDF. Excavation was completed in October 2003. The excavated material was contaminated soil and asbestos-containing material. Soil with low levels of mercury and no radioactivity above background levels was placed in the CFA landfill. Radioactive soil with low levels of mercury was placed in the ICDF, and approximately 960 yd^3 of material were staged for treatment with Portland cement before disposal in the ICDF. The excavation was backfilled with clean soil to preexcavation grade, graded to blend in with the surrounding terrain, and revegetated. Confirmatory sampling verified that remediation goals were met. It is anticipated that institutional controls at CFA-04 will be discontinued after the next 5-year review.

The CFA-08 Sewage Treatment Plant Drainfield is approximately 100 × 2,000 ft and was used to dispose of sanitary wastewater and wastewater from the INL laundry. From 1955 to 1995, the laundry cleaned protective clothing contaminated with low levels of radionuclides. The discharge contained residual quantities of radionuclides. The only COC that poses an unacceptable risk to human health is cesium-137. The maximum concentration of cesium-137 is 180 pCi/g, and the exposure route is external exposure. The selected alternative for CFA-08 was containment. Containment was determined to have high long-term effectiveness because it will eliminate the direct exposure pathway and contain contamination until risks to human health posed by the cesium-137 drop below threshold levels. In addition, it will eliminate the ecological risk exposure pathway. Short-term effectiveness was determined to be moderate because of the possibility for worker exposure during construction. The site was capped with an engineered protective cover in 2002. The cover, constructed of layers of rock and soil with a vegetative cover, will isolate the waste, inhibit intrusion by plants and animals, reduce water infiltration, and prevent wind dispersal of the waste while the cesium-137 decays. The cesium-137 will decay to levels acceptable for unrestricted use within approximately 185 years. Institutional controls are used to restrict access and intrusion. Institutional controls include visible access restrictions, control of activities (drilling or excavation), and publication of surveyed boundaries and descriptions of land-use controls in the Site institutional controls database.

The CFA-01, CFA-02, and CFA-03 Landfills, a total area of approximately 35 acres, were used to dispose of trash, cafeteria garbage, construction debris, paper, wood, masonry, scrap metal, weeds, gravel, asphalt, and asbestos until 1984. Small amounts of liquid waste, consisting of waste oil sludge, solvent, paint, paint thinner, and chemicals, also were disposed of in the landfills. Asbestos and various chemicals potentially are present but at concentrations below risk-based levels. Health risks were calculated for a current industrial scenario where it is assumed that the workers incidentally ingest soil from the landfills and ingest water from the production wells, which are considered to be downgradient of the landfills. Health risks also were calculated for a future residential scenario, where it is assumed that the residents incidentally ingest soil from the landfill cover and ingest groundwater pumped from monitoring and production wells. None of the contaminants detected as a result of data collection efforts during the remedial investigation exceeded acceptable risk values. Even though the risk assessment indicated the landfills did not present an unacceptable risk to human health, remedial actions were conducted because of uncertainty regarding waste type and composition. It was determined to be impractical to fully characterize the landfill contents because of the unsorted placement of waste into landfills. The data collected from boreholes into the waste may not be representative of the waste itself.

The three landfills were capped with engineered native soil covers in 1997. The soil covers consisted of three layers: (1) a general backfill layer that brought the existing grade up to the design slope, (2) a compacted, low-permeability soil layer, and (3) a topsoil layer that created the final grade and

allowed for growth of a vegetative cover. The landfill covers were seeded with crested wheatgrass. A detailed description of the remedial action is provided in the *Remedial Action Report CFA Landfills I, II, III Native Soil Cover Project Operable Unit 4-12* (Landis and Cotton 1997). Institutional controls include signs and permanent markers, control of activities (drilling or excavation), and publication of surveyed boundaries and descriptions of controls in the Site institutional controls database. Groundwater monitoring for VOCs, metals, and nitrates; vadose zone gas monitoring; infiltration monitoring; and maintenance of the landfill covers are required under the OU 4-13 ROD (DOE-ID 2000b).

The CFA-07 French Drains received laboratory wastewater from 1951 to 1984. The waste typically consisted of diluted acids and bases with low levels of radioactivity. These two drains were unlined, concrete block cylinders, approximately 4 ft in diameter and 8 ft deep. The drains were removed in 1995. At the north drain, all of the drain structure and discolored soil encountered during the removal were excavated, resulting in a 12-ft-deep excavation. At the south drain, radioactively contaminated soil was encountered at approximately 10 ft. Excavation continued, and the drain structure and soil were excavated to a depth of approximately 13 ft. Excavation was stopped at this depth as all of the materials associated with the drain structure had been removed, the lateral extent of contamination at depths less than 13 ft had been determined, and the levels of radioactivity were relatively low. It was determined that lead was present at 13–13.5 ft below ground in concentrations ranging from 1,460 to 4,580 mg/kg, which is above the EPA screening level of 400 mg/kg. The extent of contamination at the site begins at a depth of 12 ft and is estimated to extend to 23.5 below ground, based on the conservative assumption that the downward mobility of chemicals detected in the vadose zone at CFA-07 is 10 ft. The extent of contamination is approximately 17.5 yd^2. The volume of contaminated soil is estimated at 66.7 yd^3. This site was determined to require no further action, but institutional controls were established to prohibit future residential land use at depths greater than 10 ft. These controls consist of property transfer requirements.

The Snake River Plain Aquifer underlies the CFA landfills at a depth of 476–495 ft below ground. The local direction of aquifer flow is generally to the south-southwest. The aquifer's active portion is estimated at 250–820 ft in thickness. Aquifer flow velocity ranges from 5 to 20 ft/day. Local recharge to the aquifer is primarily through precipitation. No perched water zones are known to exist beneath the CFA.

Groundwater monitoring has been conducted in order to ensure drinking water standards are not exceeded in the aquifer because of migration of contaminants from the landfills. Groundwater samples were collected from 11 wells in the vicinity of the CFA landfills and analyzed for VOCs, anions, metals, and alkalinity. Nitrate was the only analyte that was detected above an MCL. Nitrate concentrations greater than the 10-mg/L MCL for sensitive populations were present in CFA-MON-002 (19.8 mg/L) and CFA-MON-A-003 (11 mg/L) (see Figure 4-36). The 10-mg/L MCL applies if the water is available to sensitive populations, such as infants below 6 months of age. A higher MCL of 20 mg/L applies if the water is not available to infants below 6 months of age or to other sensitive populations. The nitrate concentrations have remained stable from 1995 through 2002, with one exception of low values in 1997. Concentrations in all other wells at CFA had nitrate concentrations less than 4 mg/L (INL 2003a).

The CFA-04 Disposal Pond appears to be the probable source of nitrate in the two wells, as it is located upgradient of the wells. Liquid laboratory waste containing sodium nitrate, nitric acid, and uranyl nitrate was deposited in the pond between 1953 and 1969. Since the CFA-04 site was remediated in 2003, nitrate concentrations are expected to decrease. The OU 4-13 ROD (DOE-ID 2000b) predicted that nitrate concentrations would be below 10 mg/L by 2015. Further investigation of the elevated nitrate concentrations was not required by the ROD; however, annual determinations of nitrate levels will continue and be evaluated during 5-year reviews. After the nitrate concentration falls below the MCL of 10 mg/L, annual reporting to the state and EPA will cease (DOE-ID 2000b).

In addition to the CERCLA sites discussed above, there is an operating asbestos landfill at CFA. This landfill is used to dispose of asbestos waste removed during maintenance and DD&D actions at the INL. Once operations are discontinued and the site is closed, this area will require-long-term institutional controls to prevent intrusion.

Additional information on contaminant concentrations and risk at the five CFA sites under institutional control is provided in Table 4-8.

4.6.2 End State

A map showing CFA at the 2035 end state is provided as Figure 4-38. The CFA-08 Sewage Treatment Plant Drainfield will remain under institutional control until radioactive decay reduces the cesium-137 concentration to below risk-based levels in about 185 years. It is expected that institutional controls also will still be required at the CFA landfill sites and at CFA-07 (French Drain site) to prevent intrusion (drilling and excavation) in these areas. A conceptual site model for CFA at the end state is provided as Figure 4-39.

NE is now designated as the laboratory's LPSO and has assumed ownership of the laboratory's common-use support facilities and infrastructure, which include all of the 72 buildings at CFA. New programs are anticipated to be funded and will require either new construction or support from existing CFA facilities. DOE will determine which of the buildings will be needed for future missions. Since CFA will have a long-term nuclear mission, Figure 4-38 shows all of the existing facilities and structures although it is possible that some of the buildings may be decommissioned by 2035.

There are seven buildings at CFA that have been designated as signature properties for their historic value. These buildings were constructed between 1942 and 1945 and were used to house military personnel and otherwise support World War II activities. They include:

- CF-606 marine barracks
- CF-607 commanding officer's house and CFA-632 commanding officer's garage
- CF-613 officers' quarters
- CF-633 proofing area, which includes the containment wall, gun emplacements, and gantry crane
- CF-642 and CF-651 pumphouses.

The disposition of these buildings has not yet been determined; however, they are among the few World War II buildings remaining in Idaho and are therefore historically significant.

4.6.3 Risk Assessment Summary

Risk assessment information for CFA CERCLA sites is published in the *Remedial Investigation/Feasibility Study for Operable Unit 4-12: Central Facilities Area Landfills I, II, and III at the Idaho National Engineering Laboratory* (Keck et al. 1995) and in the OU 4-13 RI/FS (DOE-ID 2000a).

The following land-use assumptions were used in the development of the remedial action objectives for WAG 5 remediation:

- The INL is assumed to remain under government management for at least 100 years from 1995
- CFA will remain a restricted-access industrial-use site.

Risk estimates for the 100-year future residential scenario were used to identify sites for remediation.

4.6.3.1 Human Health Risk Assessment. The OU 4-13 RI/FS (DOE-ID 2000a) describes the assumptions, uncertainties, and conclusions of the human health risk assessment in detail. The following human exposure scenarios were analyzed in the OU-4-13 baseline risk assessment:

- A current occupational scenario that lasts for 25 years
- A future occupational scenario that starts in 100 years and lasts for 25 years
- A future residential exposure scenario that begins in 100 years and lasts for 30 years.

All three scenarios were evaluated assuming radioactive decay for radionuclides. For nonradionuclides, it was conservatively assumed that chemical degradation does not occur.

To evaluate potential occupational risks from exposure to soil, it was assumed that both current and future workers at the sites will only be exposed to contamination from the top 6 in. of soil for the soil ingestion, inhalation of fugitive dust, and VOC exposure routes. For the evaluation of external radiation exposure, radionuclide activities present in the top 4 ft of soil were used.

Future residents were assumed to construct 10-ft basements beneath their homes. Therefore, all contamination detected in the upper 10 ft of each site was evaluated for surface pathway exposures.

In general, only adult exposures were evaluated because of the very conservative assumptions that were incorporated in the baseline risk assessment calculations. The assumptions most likely caused the calculated risk results to overestimate the actual risks, even to sensitive subpopulations, such as children, that would result from exposure to site contamination. The exception was the soil ingestion exposure route. Under this exposure route, 6 years of childhood soil ingestion and 24 years of adult soil ingestion were included in the contaminant intake calculation.

Groundwater pathway risks were estimated at 100 years in the future for the 100-year residential exposure scenario. Maximum groundwater risks for each potential COC within 10,000 years also were estimated.

CFA-08 is the only site at CFA that still exceeds acceptable risk levels for human health. CFA-08 presents a greater than 1-in-10,000 risk to future occupational receptors and future residential receptors through the pathway of external radiation exposure. CFA-08 also poses a risk to current occupational receptors greater than 1 in 1,000,000 through the pathways of ingestion and dermal adsorption of contaminants in soil and external radiation exposure.

4.6.3.2 Ecological Risk Assessment. Wildlife species present in and around the CFA include birds, mammals, and reptiles that are associated with facilities, sagebrush-rabbitbrush, grasslands, disturbed habitats, deciduous trees and shrubs, and water (e.g., facility ponds and drainage areas). Both aquatic and terrestrial species potentially are present. Sagebrush habitats in areas next to facilities support a number of species, including sage grouse and pronghorn (important game species), and areas of grassland provide habitat for species such as the western meadowlark and mule deer, also game species.

Buildings, lawns, ornamental vegetation, and disposal or drainage ponds at CFA also are utilized by a number of species such as waterfowl, raptors, rabbits, mule deer, and bats. No areas of critical habitat are known to exist in or around CFA.

Flora surrounding WAG 4 was determined using a vegetation map constructed for the INL using LANDSAT imagery and field measurements from vegetation plots. Sagebrush-rabbitbrush is the predominant vegetation type. Fauna potentially existing in the WAG 4 area were identified primarily from a 1986 vertebrate survey performed on the INL and from data collected subsequent to the survey. Species potentially present at and surrounding WAG 4 represent all 23 INL avian functional groups and nine of 10 mammalian functional groups. Both reptilian functional groups are present. No amphibians are known to be present, and no surface hydrology exists to support fish. Aquatic invertebrates, however, are supported by habitat provided by facility disposal and drainage ponds.

Four mammalian species of concern potentially occur at or near the CFA. These include the pygmy rabbit, Townsend's western big-eared bat, the long-eared myotis, and the small-footed myotis. Presence of the gray wolf has not been verified at the INL; however, this federally listed species also was included in the assessment for completeness. The northern sagebrush lizard is the only reptile species of concern with a potential presence at WAG 4.

Avian threatened or endangered species or species of concern with a potential for occurrence in the vicinity of CFA include the ferruginous hawk, peregrine falcon, northern goshawk, loggerhead shrike, burrowing owl, bald eagle, white-faced ibis, black tern, and trumpeter swan. The bald eagle is a federally listed threatened or endangered species.

In August 1997, a field survey was conducted for individual sites of concern within the CFA area. Each site of contamination was evaluated for habitat qualities and potential to support threatened or endangered species or other species of concern. The CFA-01 landfill was the only institutionally controlled site that had high potential for habitat for sensitive species, including the burrowing owl, ferruginous hawk, peregrine falcon, and northern sagebrush lizard.

Contaminated surface soil represents the major source of possible contaminant exposure for WAG 4 ecological components. Surface soil includes the uppermost 0.5 ft. Ecological receptors can be exposed to contaminated media directly through ingestion of contaminated vegetation, water, and prey; incidental ingestion of soil; or physical contact or inhalation. Inhalation and physical contact, however, are considered to play minor roles in the exposure to surface contamination for WAG 4 and were not evaluated in the assessment. This source of contamination has been eliminated at CFA through completion of the remedial actions.

Contaminants in subsurface soil can be transported to ecological receptors by plant uptake and translocation by burrowing animals. Once contaminated soil is brought close to the surface, transport and exposure scenarios for ecological receptors are the same as for surface soil. Inhalation and direct contact by burrowing animals are more important exposure routes for subsurface contamination than for surface contamination. Receptors having potential for direct exposure to WAG 4 subsurface soil contamination include animals dwelling below ground and deep-rooting plants. Contamination at depths greater than 10 ft is considered inaccessible to ecological receptors because that depth generally is below the root zone of plants and the burrowing depth of ground-dwelling animals.

Surface water flow and accumulation in and around WAG 4 are generally limited to spring run-off, and intense precipitation events and no major natural drainages occur at WAG 4. Surface flows are limited to localized run-off, particularly from paved areas or existing facilities. None of the sites of concern evaluated in the ecological risk assessment had standing surface water, and no pathway to

ecological receptors exists for groundwater at WAG 4. Consequently, these pathways were not evaluated as part of the assessment.

Ten sites were found to pose potential risk to ecological receptors. These sites all had ecological HQs greater than 10. These sites were subsequently further evaluated in the Sitewide ecological risk assessment documented in the OU 10-04 RI/FS. Two of the sites (CFA-04 and CFA-08) also exceeded human health risk thresholds. For these two sites, it was concluded that the remedial actions to address human health risks also would address risk to ecological receptors.

Table 4-8. Contaminant concentrations and risk levels for sites under institutional control at the Central Facilities Area.

Site Number	Contaminants of Concern	Final Remediation Goal[a] and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	ICs for >100 Years	Basis for ICs and Comments
CFA-01 (former landfill)	None	N/A	Not available	<1 in 10,000	<1 in 10,000	<1 in 10,000	No	Complete (containment)	Yes	Required to prevent intrusion into waste.
CFA-02 (former landfill)	None	N/A	Not available	<1 in 10,000	<1 in 10,000	<1 in 10,000	No	Complete (containment)	Yes	Required to prevent intrusion into waste.
CFA-03 (former landfill)	None	N/A	Not available	<1 in 10,000	<1 in 10,000	<1 in 10,000	No	Complete (containment)	Yes	Required to prevent intrusion into waste.
CFA-04 (disposal pond)	Mercury	0.50 mg/kg (ecological)	<0.5 mg/kg[b]	No[c]	No[c]	No[c]	No[c]	Complete	No	It is anticipated that ICs will no longer be discontinued during the next 5-year review.
CFA-07 (French drains)	Lead	N/A	74–4,580 mg/kg	No	No	No	No[d]	No Further Action	Yes	Total risk is <1 in 1,000,000 and hazard index is <1 for up to 10 ft below ground. ICs are required to prevent intrusion at depths greater than 13 ft below ground, where lead and radionuclide contamination are present.
	Silver-108m	N/A	0.29–0.43 pCi/g	No	No	No	No[d]	No Further Action		Required to prevent intrusion at depths greater than 13 ft below ground, where lead and radionuclide contamination are present.

Table 4-8. (continued).

Site Number	Contaminants of Concern	Final Remediation Goal[a] and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	ICs for >100 Years	Basis for ICs and Comments
	Cesium-137	N/A	26.3–104 pCi/g	4 in 1,000,000	No	No	No[d]	No Further Action		Required to prevent intrusion at depths greater than 13 ft below ground, where lead and radionuclide contamination are present.
	Plutonium-238	N/A	0.08–9.3 pCi/g	3 in 10^8	No	No	No[d]	No Further Action		Required to prevent intrusion at depths greater than 13 ft below ground, where lead and radionuclide contamination are present.
CFA-08 (Sewage Treatment Plant Drainfield)	Cesium-137	N/A	0.08–180 pCi/g under engineered soil cover	2 in 1,000	2 in 10,000 from external exposure	4 in 10,000 from external exposure	No	Complete (containment)	Yes	Required to protect current occupational, future occupational, and future residential receptors from external exposure to cesium-137 for approximately 185 years until risk is <1 in 10,000.

Sources of Information:

OU 4-13 RI/FS (DOE-ID 2000a)

OU 4-13 ROD (DOE-ID 2000b)

a. Remediation goals were based on risk to the hypothetical 100-year resident

b. The ecological goal was lower than the human health goal of 1.27 mg/kg

c. Site has been remediated

d. Contamination is >10 ft deep, so there is no pathway to ecological receptors.

IC = institutional control
N/A = not applicable

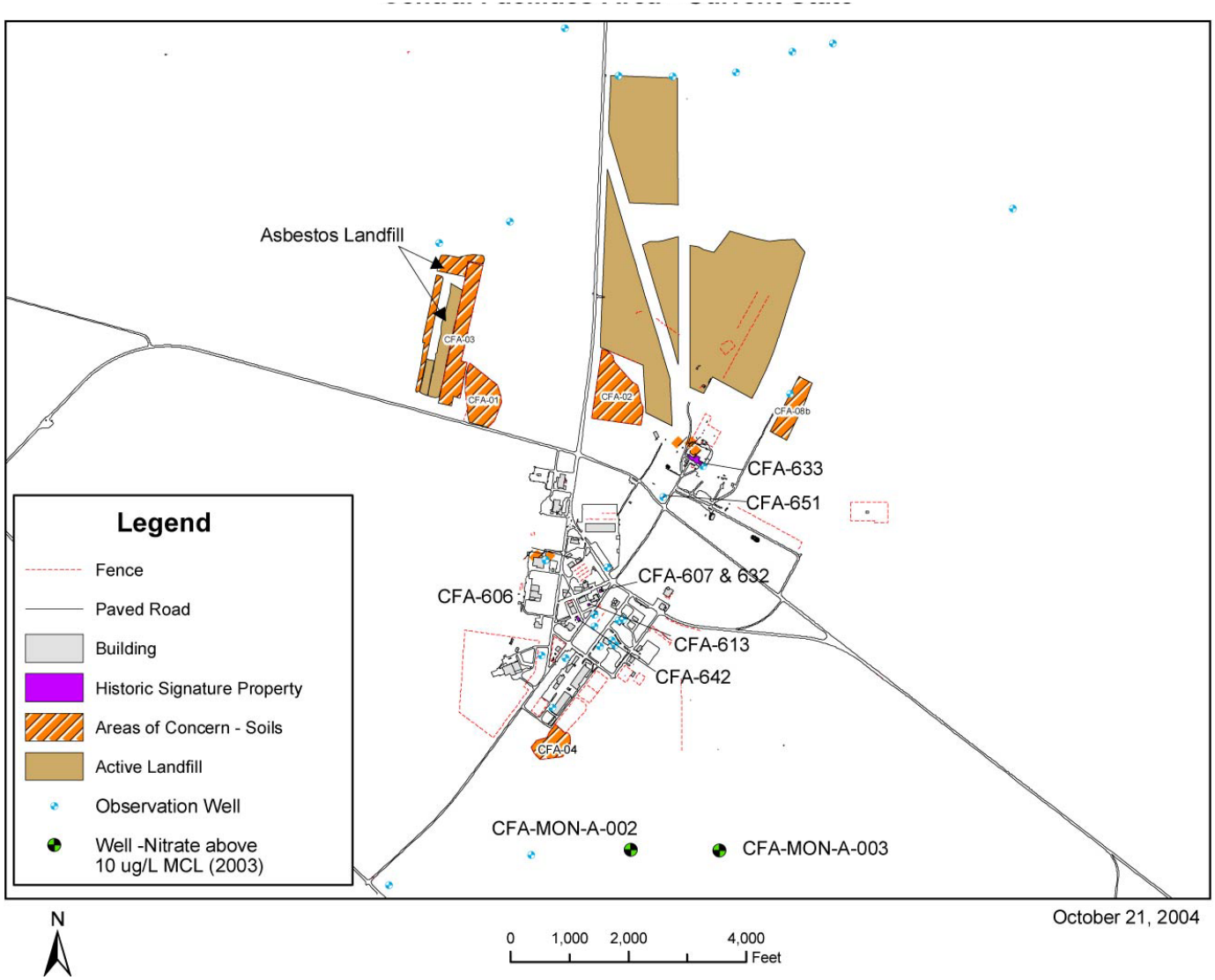


Figure 4-36. Central Facilities Area map—current state.

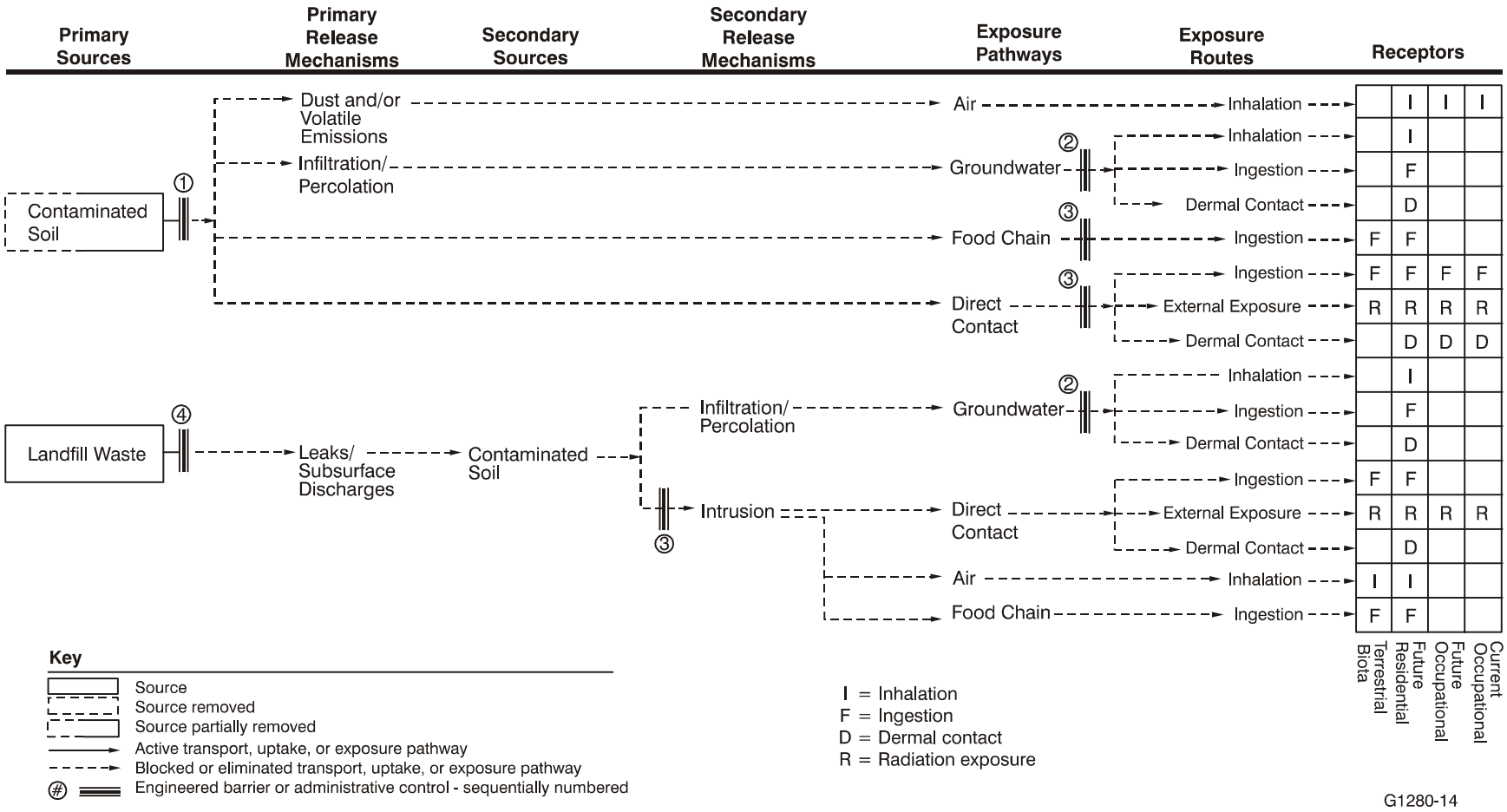


Figure 4-37. Central Facilities Area conceptual site model—current state.

Narrative for Figure 4-37 Central Facilities Area Conceptual Site Model—Current State

All active remedial actions have been completed. There are currently five sites where institutional controls are in place because residual contamination precludes unrestricted access. These areas include:

- Three capped landfill sites (CFA-01, CFA-02, and CFA-03).
- The CFA-07 French Drain site. The French Drains have been removed, and the site does not present a human health risk to a depth of 10 ft. However, institutional controls are in place to control activities, such as drilling or excavation, as residual lead and radionuclide contamination is present at depths below 13 ft.
- The CFA-08 Sewage Treatment Drainfield site. This area contains cesium-137 above risk-based levels and has been capped with an engineered native soil cover. Institutional controls are maintained to protect occupational and hypothetical residential receptors while the radionuclides decay. The estimated time for the cesium-137 to decay to levels that do not present a risk for residential use is 185 years.

Actions and Barriers:

The steps taken to mitigate or remove these hazards are as follows:

1. The selected remedy for the CFA-04 site was excavation of mercury contaminated with disposal in the ICDF, thus removing the source of contamination. The CFA-08 site was capped with an engineered native soil cover in 2002. The cover isolates the contaminated soil, inhibits intrusion by plants and animals, reduces water infiltration, and prevents dust or volatile emissions from the site. Institutional controls include visible access restrictions, control of activities (drilling or excavation), and publication of surveyed boundaries and descriptions of land-use controls in the Site institutional controls database. The source of contamination at the CFA-07 site also was removed; however, some residual contamination is suspected to remain below 13 ft. Therefore, institutional controls were established to prohibit future residential land use at depths greater than 10 ft. These controls consist of property transfer requirements. The entire INL Site has restricted access to prevent intrusion by the public.

2. Nitrate concentrations are above the 10-mg/L MCL for sensitive populations (e.g., infants below 6 months of age) in two monitoring wells at CFA. The source of the elevated nitrate is believed to be the CFA-04 Disposal Pond site. This site was remediated in 2003, so nitrate concentrations are expected to decrease. Nitrate concentrations are determined annually. Nitrate concentrations and trends will be evaluated during the 5-year reviews to determine if any actions are needed. These two wells are not used to provide drinking water to INL employees. Water quality from potable water wells is closely monitored. Groundwater monitoring is conducted under the *Post-Record of Decision Monitoring Work Plan for the Central Facilities Area Landfills I, II, and III Operable Unit 4-12* (INL 2003b) and will continue until such time as the 5-year reviews show and the agencies agree that it is no longer necessary.

   The entire INL Site has restricted access to prevent intrusion by the public.

3. The entire INL Site has restricted access to prevent intrusion by the public. Workers are protected through posting of signs at contaminated sites, by recording contaminated sites in the Site institutional controls database, through radiological control training, and through the work control process used to identify hazards and mitigation measures for planned work activities.

4. The three landfill sites were capped with engineered native soil covers in 1997. Institutional controls include signs and permanent markers, control of activities (drilling and excavation), and publication of surveyed boundaries and descriptions of controls in the Site institutional controls database. Groundwater monitoring for VOCs, metals, and nitrates; vadose zone gas monitoring; infiltration monitoring; and maintenance of the landfill covers are conducted as required by the OU 4-13 ROD (DOE-ID 2000b).

Failure Analysis:

The three landfill sites have been capped with engineered native soil covers, as has the sewage plant drainfield (CFA-08). The three landfill sites do not pose unacceptable risk to human or ecological receptors; they were capped as a conservative measure because of the uncertainty regarding the nature and extent of contamination. CFA-08 poses unacceptable risk to current occupational receptors as well as to the hypothetical 100-year future resident. The radiation at CFA-08 will decay to acceptable levels in about 185 years.

The OU 4-13 ROD (DOE-ID 2000b) concluded that the remedy for CFA-08 represented a permanent solution to the maximum extent practicable. The engineered cap is projected to be effective over the 185-year timeframe needed until natural radioactive decay of cesium-137 causes concentrations to fall below acceptable exposure levels. After 185 years, the remedy will be considered permanent because the radiation will no longer pose an unacceptable risk to human health.

Continued effectiveness of the barrier is evaluated by monitoring soil-cover integrity and performing aboveground radiological surveys. The soil covers at the three landfills have been inspected annually since 1997. The first 5-year review was performed in 2002. The recommendation of the 5-year review was to continue annual inspections at CFA landfills. Factors evaluated during inspections included vegetative cover, erosion, effectiveness of water run-off, topographical survey, signs of animal intrusion, and condition of rock armor on CFA-02. The second 5-year review for CFA landfills will be conducted in 2007. The frequency of inspections may be adjusted following this review.

Inspections have been performed annually at CFA-08 since 2002 to verify the integrity of the cover. The inspections evaluated erosion, vegetation, animal intrusion, and radiological conditions. The first 5-year review for CFA-08 will be performed as part of the comprehensive WAG 4 5-year review in 2007. The frequency of inspections at CFA-08 may be adjusted following this review.

Measures used to monitor the covers at CFA sites are documented in the *Operations and Maintenance Plan for the Final Selected Remedies at Central Facilities Area, Operable Unit 4-13* (DOE-ID 2004i). Should a cover fail, the DOE Idaho will determine the nature and extent of repairs with concurrence from DEQ and EPA.

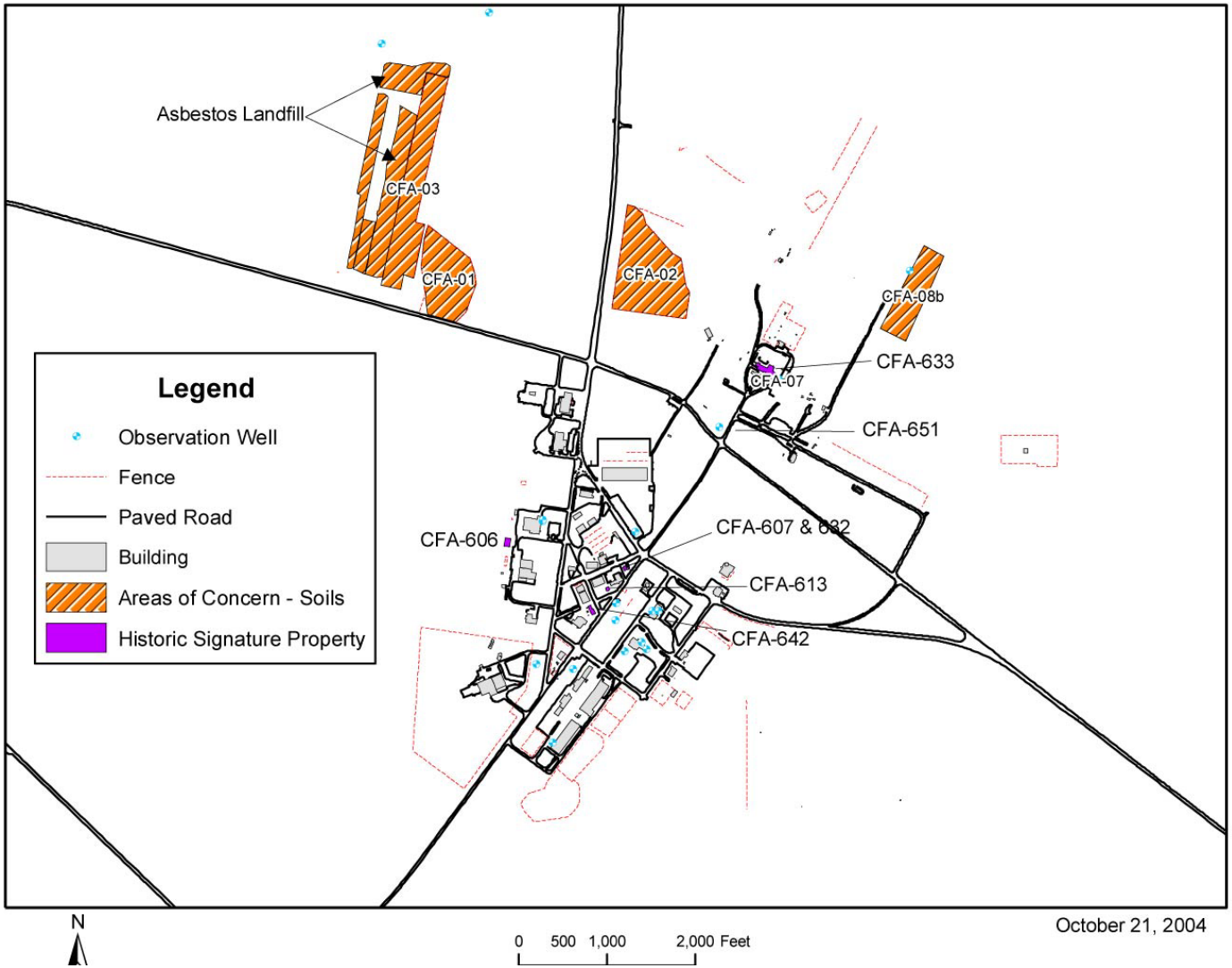


Figure 4-38. Central Facilities Area map—end state.

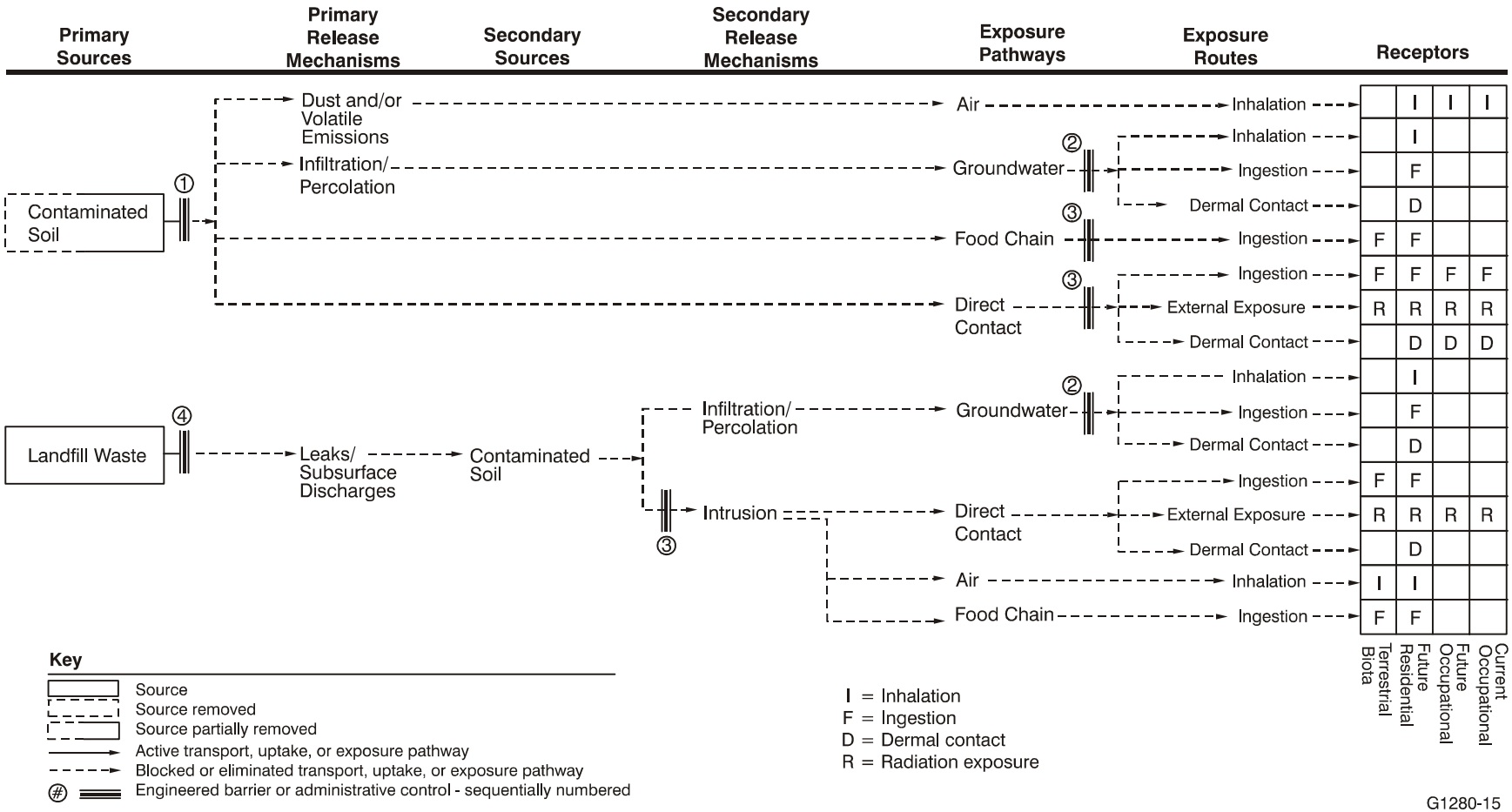


Figure 4-39. Central Facilities Area conceptual site model—end state.

Narrative for Figure 4-39 Central Facilities Area Conceptual Site Model—End State

At the end of the EM cleanup mission, it is expected that institutional controls will continue to be required to protect human health at five sites. The five sites where institutional controls will continue to be required include:

- Three capped landfill sites (CFA-01, CFA-02, and CFA-03)
- The CFA-07 French Drain site. The French Drains have been removed, and the site does not present a human health risk to a depth of 10 ft. However, institutional controls are in place to control activities, such as drilling or excavation, as residual lead and radionuclide contamination is suspected at depths below 13 ft.
- The CFA-08 Sewage Treatment Drainfield site. This area contains cesium-137 above risk-based levels and has been capped with an engineered native soil cover. Institutional controls will be maintained to protect occupational and hypothetical residential receptors while the radionuclides decay. The estimated time for the cesium-137 to decay to levels that do not present a risk for residential use is 150 years following the end of the EM cleanup mission.

Actions and Barriers:

The steps taken to mitigate or remove these hazards are as follows:

1. The CFA-08 site was capped with an engineered native soil cover in 2002. The cover isolates the contaminated soil, inhibits intrusion by plants and animals, reduces water infiltration, and prevents dust or volatile emissions from the site. Institutional controls include visible access restrictions, control of activities (drilling or excavation), and publication of surveyed boundaries and descriptions of land-use controls in the Site institutional controls database. The source of contamination at the CFA-07 site also was removed; however, some residual contamination is suspected to remain below 13 ft. Therefore, institutional controls were established to prohibit future residential land use at depths greater than 10 ft. These controls consist of property transfer requirements. The entire INL Site has restricted access and use to prevent intrusion by the public.

2. All groundwater at CFA will be below MCLs at the end state. The entire INL Site has restricted access and use to prevent intrusion by the public.

3. The entire INL Site has restricted access to prevent intrusion by the public. Workers are protected through posting of signs at contaminated sites, by recording contaminated sites in the Site institutional controls database, through radiological control training, and through the work control process used to identify hazards and mitigation measures for planned work activities. Potable water wells used to supply drinking water to workers are routinely monitored for water quality. In the event that the DOE mission should end at some unknown time in the future, deed restrictions would be required to prevent intrusion into those areas with residual contamination.

4. The three landfill sites were capped with engineered native soil covers in 1997. Institutional controls include signs and permanent markers, control of activities (drilling and excavation), maintenance of the covers, and publication of surveyed boundaries and descriptions of controls in the Site institutional controls database. It is possible that some of the monitoring activities currently required by the OU 4-13 ROD (DOE-ID 2000b) may be discontinued based on the results of 5-year reviews. In the event that the DOE mission should end at some unknown time in the future, deed restrictions would be required to prevent intrusion into those areas with residual contamination.

Failure Analysis:

The three landfill sites have been capped with engineered native soil covers, as has the sewage plant drainfield (CFA-08). The three landfill sites do not pose unacceptable risk to human or ecological receptors; they were capped as a conservative measure because of the uncertainty regarding the nature and extent of contamination. CFA-08 poses unacceptable risk to current occupational receptors, as well as to the hypothetical 100-year future resident. The radiation will decay to acceptable levels in about 185 years.

The OU 4-13 ROD (DOE-ID 2000b) concluded that the remedy for CFA-08 represented a permanent solution to the maximum extent practicable. The engineered cap is projected to be effective over the 185-year timeframe needed until natural radioactive decay of cesium-137 causes concentrations to fall below acceptable exposure levels. After 185 years, the remedy will be considered permanent because the radiation will no longer pose an unacceptable risk to human health.

Long-term stewardship requirements for the covers will be identified before the end of the EM mission.

4.7 Waste Reduction Operations Complex/Power Burst Facility and Auxiliary Reactor Area

The Waste Reduction Operations Complex (WROC)/Power Burst Facility (PBF) and Auxiliary Reactor Area (ARA) are located fairly close together in the south-central portion of the INL Site and were all experimental reactor facilities built in the 1950s.

The ARA-I facility was built in 1957 to support the Stationary Low-Power Reactor No. 1 (SL-1). The SL-1 reactor was built in 1957 and operated intermittently from 1958 until it was destroyed by an accident in January 1961. The ARA facility housed several Army Reactor Program experiments until the program was phased out in 1965. The main buildings at ARA-II were converted to offices and welding shops. The ARA-II facility also contained several minor structures, such as a guardhouse, a well house, a chlorination building, a decontamination and laydown building, a power extrapolation building, an electrical substation, and several storage tanks. The ARA-I and ARA-II facilities were formally shut down in 1988 and 1986, respectively. DD&D was initiated in 1995 and has been completed. Construction of the ARA-III facility was completed in 1959 to house the Army Gas Cooled Reactor Experiment research reactor. Experiments with the reactor continued until the plant was deactivated in 1961. In 1963, the ARA-IV facility was modified to support the Mobile Low-Power Reactor series of tests conducted at ARA-IV and remained active until late 1965 when the army reactor program was phased out. In 1969, two buildings were constructed at ARA-III to provide additional laboratory and office space in support of other INL programs. The facility was shut down in 1989. DD&D was initiated in 1990 and completed in 1999. The ARA-IV facility was built to accommodate the Mobile Low-Power Reactor I, an active project from 1957 to 1964. The Nuclear Effects Reactor was operated at ARA-IV from 1967 to 1970. The area was closed down until 1975, at which time it was used temporarily for some welding qualification work. DD&D was performed in 1984 and 1985. Since 1985, the area has been used occasionally for testing explosives in powered-metal manufacture experiments. A small control building, a bunker, the buried remains of two leach pits, and a sanitary waste system are all that remain.

PBF and the Control Area were originally built in the late 1950s for remote control of Special Power Excursion Reactor Test (SPERT) experiments. Later, the PBF reactor was constructed in 1972, put on standby in 1985, and shut down in 1998. Fuel was removed from the reactor pools in 2004 and is now in dry storage at INTEC. Cleanup activities are scheduled to be complete by 2012. The Control Area facilities provide raw water storage and distribution, administrative offices, instrument and mechanical work areas, and data acquisition resources.

The buildings that currently comprise WROC were originally built to contain the SPERT reactors. The SPERT reactor tests involved four reactors. SPERT-I reactor was operated from 1955 to 1964. It was decommissioned in 1964 and demolished in 1985. The SPERT-II reactor was operated from 1960 to 1964. After the reactor was removed, the facility was converted for research purposes. The SPERT-III reactor was constructed in the late 1950s and operated from 1958 to 1968. The reactor building was decontaminated in 1982, and the building was modified to contain the Waste Experimental Reduction Facility Incinerator (see Figure 4-40). All four SPERT reactor vessels are buried in the RWMC. Decontamination and dismantlement of the incinerator was completed in 2003. The SPERT-IV reactor was operational from 1961 to 1970. After the reactor was removed, the building was converted to a mixed waste storage facility. All waste stored in the building was removed in September 2003, and the facility completed RCRA closure in 2004.

Remedial actions for WAG 5 were evaluated in *Waste Area Group 5 Operable Unit 5-12 Comprehensive Remedial Investigation/Feasibility Study* (Holdren et al. 1999) and in the *Remedial Investigation/Feasibility Study Report for Operable Units 5-05 and 6-01 (SL-1 and BORAX-1 Burial Grounds)* (Holdren, Filemyr, and Vetter 1995).

Three RODs and two time-critical removal actions have been completed at ARA and PBF. The OU 5-05 and 6-01 ROD (INL 1996), which addressed the ARA-06 SL-1 Burial Ground and 10 additional sites, was implemented in 1996. The *Power Burst Facility Record of Decision: Power Burst Facility Corrosive Waste Sump and Evaporation Pond, Operable Unit 5-13, Waste Area Group 5* (DOE-ID 1992c) addressed the PBF-08 Corrosive Waste Sump and the PBF-10 Evaporation Pond. Remediation of these areas was completed in 1994. The *Record of Decision: Auxiliary Reactor Area-1 Chemical Evaporation Pond, Operable Unit 5-10* (DOE-ID 1992d) addressed the ARA-01 Chemical Evaporation Pond.

Figure 4-40. Aerial view of the Waste Experimental Reduction Facility with the Control Area shown in the distance.

Fifty-five sites of known or suspected contaminant release were evaluated in the *Record of Decision for the Power Burst Facility and Auxiliary Reactor Area, Operable Unit 5-12* (hereinafter referred to as the OU 5-12 ROD) (DOE-ID 2000c). Five contaminated soil sites (ARA-01, ARA-12, ARA-23, ARA-25, and PBF-16), one sanitary waste system site (ARA-02), and one radionuclide tank site (ARA-16) were determined to require remediation.

In addition to the CERCLA cleanup activities, a release investigation of a heating fuel release near building PER-620 was recently conducted in accordance with Idaho's *Risk-Based Corrective Action Guidance Document for Petroleum Releases* (DEQ 1996). The PER-722 underground storage tank is located immediately next to and on the north side of the PBF reactor building (PER-620). The tank is a 10,000-gal, single-walled carbon steel tank that was used to supply heating fuel to PBF-620. The tank was installed in 1971 and was in continual use until the discovery of a possible leak in June 2002. During routine gauging of the tank, a decrease in product level was observed, and a release was reported to the

DEQ. Following removal of the remaining product from the tank, a state-certified vendor performed a tank-tightness determination. The results of that test confirmed the presence of a leak in PER-722. Engineering calculations indicate that as much as 17,000 gal of product may have leaked into the subsurface between November 1999 and June 2002.

The COPCs include those associated with No. 2 diesel fuel and include benzene, toluene, ethyl benzene, and xylenes and polynuclear aromatic hydrocarbons, including acenapthene, anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)anthracene, benzo(g,h,i)perylene, chrysene, fluorene, fluoranthene, naphthalene, phenanthrene, and pyrene. In April 2003, a single core hole was installed near the PER-722 tank to a depth of 140 ft below land surface. Evidence of diesel contamination was present in the core and continued to the bottom of the coring. Based on review of the data collected from the core hole, additional characterization was conducted to define the extent of contamination into the underlying basalt and sedimentary interbeds and to determine if an impact to the Snake River Plain Aquifer may exist. A second core hole was drilled to the aquifer. The core samples showed the presence of diesel in permeable zones, with the last noted presence of diesel occurring at 327.5 ft below ground. No evidence of diesel fuel, either visual or analytical, was detected below that depth. A piezometer was installed in the core hole, allowing the collection of groundwater samples from the aquifer. Groundwater was encountered at 456.3 ft below ground. Other than toluene at a concentration below MCLs, no potential COCs were detected in the aquifer samples. Upon review of the information, DEQ issued a schedule and criteria for the petroleum release from PER-722, requiring 3 years of groundwater monitoring to ensure that the release does not adversely impact the Snake River Plain Aquifer. Groundwater monitoring will be conducted as described in the approved *Groundwater Monitoring Plan for the PER-722 Underground Storage Tank Diesel Fuel Release* (DOE-ID 2004j).

4.7.1 Current State

Maps showing the current state of this area are included as Figures 4-41 and 4-42. Remedial actions at sites ARA-02, ARA-16, ARA-25, and PBF-16 have been completed. Remedial actions at sites ARA-01, ARA-12, and ARA-23 will be completed by the end of 2004. Site ARA-01 will be remediated to address human health risks from arsenic and potential risks to ecological receptors from exposure to selenium and thallium. Site ARA-12 will be remediated to address human health risks from silver-108m and cesium-137 and ecological risks from copper, mercury, and selenium in surface and subsurface soil. An area of elevated gamma activity to the southwest of the site also will be remediated. Site ARA-23, which includes the radiological contaminated soil around ARA-I and ARA-II, the remaining reactor foundation, and remaining underground utilities within the facility fences, will be remediated to address the human health risks from cesium-137. A conceptual site model that represents the current state conditions is provided as Figure 4-43.

Currently, institutional controls are maintained at the following sites:

- ARA-01 ARA-I (Chemical Evaporation Pond). This site is a shallow, unlined surface impoundment, roughly 100 × 300 ft in size, which was used to dispose of laboratory wastewater from the ARA-I Shop and Maintenance Building. Basalt outcrops are present within and next to the pond. From 1970 to 1988, the pond received discharges that contained small quantities of radioactive substances, acids, bases, and VOCs. Arsenic was identified as a COC based on human health risk estimates. COCs that pose potential risks to ecological receptors are selenium and thallium. Contaminants are limited to shallow surface sediments at depths less than 3.5 ft. Because arsenic poses an unacceptable risk to human health, site access has been restricted until remediation is implemented. Land-use controls will not be required after remediation if contaminated soil is removed and residual contaminant concentrations do not pose an unacceptable risk.

- ARA-02 ARA-I (Sanitary Waste System). This site was a sanitary septic system used from 1960 until 1988 when ARA-I was inactivated. The system was designed and intended exclusively for sanitary waste. No known process waste was routed to the system, and no recorded spills or documented incidents were associated with the septic system; however, periodic surveys indicated radiological contamination. The source of the contamination is unknown. The COCs, based on human health risks, were lead, Aroclor-1242, radium-226, cesium-137, uranium-235, and uranium-238. No COCs were identified for ecological receptors. The entire septic system was removed in accordance with the requirements of the OU 5-12 ROD (DOE-ID 2000c). The seepage pit sludge was removed and disposed of, thus mitigating the human health risk associated with this site. All of the remedial action waste was shipped to the Envirocare waste site for disposal. Based upon comparison of the postremediation contaminant concentrations to the remediation goals, remediation of the ARA-02 site was determined to be successful. However, a few isolated locations still have cesium-137 contamination above 23 pCi/g because of windblown spread from ARA-23. These areas will be addressed during remediation of the ARA-23 site, after which the need for continued institutional controls will be reevaluated.

- ARA-03 ARA-I (lead sheeting pad near ARA-627). This site is a 7,198-ft^2 contaminated soil area. The source of contamination is unknown. Lead sheeting was placed over the area for shielding when it was first identified in 1979 during a routine radiation survey. The COC was cesium-137. The sheeting was removed in 1991. In 1994, soil to a depth of 3 ft was removed and disposed of at the RWMC. The site was backfilled with 3 ft of clean soil and seeded with grass. Because of the presence of residual cesium-137, the site has been restricted to industrial use with institutional controls. However, risk to both occupational and future residential receptors is below 1 in 10,000.

- ARA-06 ARA-II (Stationary Low-Power Reactor No. 1 Burial Ground). The site contains radioactive debris, soil, and gravel from the 1961 SL-1 reactor accident and cleanup. In 1996, a remedial action consisting of an engineered barrier was implemented because of exposure to radiological contaminated soil and waste from the 1961 SL-1 reactor accident and cleanup. The site has an estimated baseline risk of 1 in 100 for the 100-year future residential scenario from exposure to radiologically contaminated soil and waste, diminishing to 1 in 10,000 in approximately 400 years. Because of the elevated baseline risk, land-use controls are maintained to inhibit intrusion into the buried waste.

- ARA-07 ARA-II (Seepage Pit to East) (ARA-720A). This site was a concrete-block-lined seepage pit located just outside the ARA-II facility fence that was the terminus of two septic tanks. Closure activities at this site included removal of the fencing, roof structure, and top two courses of cinder blocks and disposal at the CFA bulky-waste landfill. The seepage pit was abandoned in place according to Idaho Administrative Procedures Act standards. The excavation was backfilled and compacted. No COCs were identified for this site; however, based on historical analytical data, it was determined that the site should be restricted to industrial land use because of residual cesium-137 contamination that remains in the seepage pit sludge.

- ARA-08 ARA-II (Seepage Pit to West) (ARA-720B). This site was a concrete-block-lined seepage pit located just outside the ARA-II facility fence that received waste from the Administrative and Technical Support building in the ARA-II facility. The three concrete lids covering the seepage pit were excavated and disposed of at the CFA landfill. The seepage pit was abandoned in place according to Idaho Administrative Procedures Act standards, and the excavation was backfilled and compacted. No COCs were identified for this site; however, based on historical analytical data, it was determined that the site should be restricted to industrial land use because of residual cesium-137 contamination that remains in the seepage pit sludge.

- ARA-12 ARA-III (Radioactive Waste Leach Pond). This site is an unlined surface impoundment approximately 370 × 150 ft in size. The pond was used from 1959 to 1965 to dispose of low-level liquid waste from reactor research operations. From 1966 to 1987, the pond received only discharges from the water storage tank and facility run-off. The COC is silver-108m. Contamination was detected to a depth of 5–7 ft. Ecological HQs are greater than 10 from exposure to copper, mercury, and selenium. Because of the presence of silver-108m, which poses an unacceptable human health risk, institutional controls are maintained until remediation is completed, at which time requirements for continued institutional controls will be reevaluated. Remediation is in progress and will be completed in 2004.

- ARA-16 ARA-I (Radionuclide Tank). This site was a 1,000-gal stainless steel underground holding tank resting within a lidless concrete vault and covered by approximately 3.5 ft of soil. The tank received radioactive liquid waste, along with methanol, acetone, chlorinated paraffin, and mixed acids, from 1959 to 1988. The waste was removed from the tank, and the tank, piping, and concrete vault were removed in accordance with the OU 5-12 ROD (DOE-ID 2000c). The soil COC was cesium-137. In situ measurement of the basalt soil underlying the tank and vault demonstrated that the maximum cesium-137 concentration remaining was 1.5 pCi/g, which is below the remediation goal of 23 pCi/g. Because the remaining contaminant concentration is below the remediation goal, remediation of the ARA-16 site was determined to be successful. However, low levels of cesium-137 contamination remain in the surface soil overlying the ARA-16 site. This contamination is attributed to windblown spread of contamination from ARA-23. These areas will be addressed during remediation of the ARA-23 site, after which the need for continued institutional controls will be reevaluated.

- ARA-23 (radiological contaminated surface soil around ARA-I and ARA-II). This is a 42-acre windblown contamination area. The COC is cesium-137. Contaminant concentrations range from 0.27 to 2,140 pCi/g, with an average concentration estimated at 88.5 pCi/g. The contamination extends to 2 ft below ground. Remediation is in progress and will be completed in 2004.

- ARA-24 ARA-III (windblown soil). Estimated baseline risks for this site are less than 1 in 1,000,000 for all scenarios. However, a contaminated pipeline embedded in concrete 20 ft below grade remains. Because of the presence of the contaminated pipeline, land use has been restricted to prohibit potential exposure to radiologically contaminated material. Any future land transfer would require communication of appropriate land-use restrictions.

- ARA-25 ARA-I (soil beneath the ARA-626 Hot Cells). This site consists of contaminated soil that was discovered beneath the ARA-626 hot cells during DD&D of the ARA-1 facility in 1998. The contamination was found near the hot cell floor drains. The COCs based on human health risks were arsenic, lead, cesium–137, and radium-226. There are potential risks to ecological receptors from exposure to copper and lead. The hot cell foundation was removed, allowing excavation of the underlying and immediately surrounding soil to basalt. The contaminated soil was removed in accordance with the ROD, and the soil and hot cell foundation were disposed of at the RWMC. Cesium-137 was used as a marker to calculate concentrations of the remaining contaminants based on the ratio of their maximum concentrations to that of cesium-137. In situ measurement of the basalt layer demonstrated that the maximum cesium-137 concentration remaining was 398 pCi/g, which exceeds the remediation goal of 23 pCi/g. Although the remaining contaminant concentrations exceed the remediation goal, the ROD stipulated that remediation goals can be satisfied either by cleaning up to the identified contaminant concentration or by removing all soil down to the basalt interface. Because the contaminated soil was removed down to the basalt interface, remediation of the ARA-25 site was determined to be successful; however, because contamination remains at the site, institutional controls are required.

- PBF-10 PBF (Reactor Area Evaporation Pond) (PBF-733). This site was a 19,600-ft^2, Hypalon-lined surface impoundment used from 1972 to 1984. The COC is cesium-137. An interim action was completed in 1994 and in 1995 when the pond liner was removed, the berm was pushed into the pond, and the area was graded and seeded with native grass. The postremediation risk is 2 in 100,000 for the 100-year future residential scenario from exposure to cesium-137.

- PBF-12 PBF SPERT-I (Leach Pond). This site is the historical location of a 15 × 45-ft, diced, unlined surface impoundment. The site received radiologically contaminated and nonradioactive overflow from the SPERT-I reactor pit on a sporadic basis from 1955 to 1964. In 1984, DD&D was performed at the site. Remediation included removing the drain line and the top 2.5 ft of contaminated soil. The area was mounded slightly with an 8-ft cover of clean soil and seeded with grass. Risk evaluation for this site identified no current occupational risk and a 100-year future residential risk of 2 in 100,000 from exposure to cesium-137. Institutional controls are maintained to restrict this site to industrial use only.

- PBF-13 PBF (Reactor Area Rubble Pit). This site was used to dispose of basalt soil excavated during facility construction in the late 1960s and later used as a landfill for construction materials and piping with asbestos insulation. All visible materials containing asbestos were removed in 1993, and the pit was backfilled with clean basalt soil rubble. There is no unacceptable risk, but the site contains construction waste, possibly friable asbestos. Institutional controls are maintained to prohibit intrusion and potential exposure to the friable asbestos. Recommendations for appropriate land-use restrictions will accompany any future land transfer.

- PBF-21 PBF SPERT-III (Large Leach Pond). This site was a leach pond that received primary cooling-water waste from the sump pump in the SPERT-III reactor building from 1958 to 1968. The pond was sampled, partially excavated, and backfilled in 1983. The contamination is covered by an 8-ft-thick layer of soil. COCs are cesium-137 and uranium-238. Estimated risk for this site is 1 in 100,000 for the 100-year future residential scenario.

- PBF-22 PBF SPERT-IV (Leach Pond) (PBF-758). This site was an unlined surface impoundment that received effluent from the SPERT-IV reactor from 1956 to 1970. The COCs are cesium-137 and arsenic. In 1985, the site was surveyed, and contaminated soil was removed and transported to the RWMC for disposal. Risk from exposure to arsenic is 2 in 10,000 for the 100-year future residential scenario. The site has been restricted to industrial land use only.

- PBF-26 PBF SPERT-IV (lake). This site was a large surface impoundment constructed in 1960. From 1961 to 1970, it received uncontaminated cooling water from the secondary loop of the SPERT-IV reactor. From 1985 to 1992, the lake received uncontaminated effluent only. The COCs are arsenic, Aroclor-1254, cesium-137, uranium-235, and uranium-238. Risk for the 100-year future residential scenario is estimated to be 3 in 10,000.

There are currently four sites under institutional control, where risk to both current occupational and the 100-year residential receptors is less than 1 in 10,000. These sites are ARA-03, PBF-10, PBF-12, and PBF-21. The OU 5-12 ROD (DOE-ID 2000c) describes the following logic that was used to determine which sites required institutional controls:

> Institutional controls will be maintained by DOE at any CERCLA site at the INL where risk is greater than 1 in 10,000 for a hypothetical *current* residential scenario (emphasis added). However, baseline risk assessments at the INL typically do not estimate risk for a current residential scenario. For purposes of evaluating the need for institutional controls at WAG 5, the potential for current

residential risk in excess of 1 in 10,000 was inferred from the risk assessment for the 100-year future residential scenario. Any site with 100-year future residential scenario with an estimated risk of 1 in 1,000,000 or greater was assumed to pose a current residential risk of 1 in 10,000.

Additional information on contaminant concentrations and risk levels for the 17 sites currently under institutional control is provided in Table 4-9.

The majority of VCO actions at PBF will be completed by the end of 2004. One action will continue into 2005.

4.7.2 End State

Two maps and a conceptual site model showing anticipated conditions at the end state are included as Figures 4-44, 4-45, and 4-46.

The WROC area is expected to have a long-term industrial mission supporting various NE programs. Fourteen excess facilities have been identified at the WROC/PBF and ARA areas. These all will be decommissioned before 2035. One of the facilities, the PBF reactor, has been identified as a high-risk facility because of extensive radioactive materials and contamination. Although the PBF reactor building has not yet been fully characterized and the end state has therefore not yet been determined, it may not be possible to demolish and remove the facility because of concerns related to worker exposure. Therefore, the PBF reactor facility is shown on the map as a grouted and capped facility. Actual alternatives for disposition of this facility are being evaluated through the CERCLA process for non-time-critical removal actions. RCRA implications also are being evaluated.

Following the first 5-year remedy effectiveness review in 2005, it is anticipated that maintenance of institutional controls at five of the sites that have been remediated (ARA-01, ARA-02, ARA-12, ARA-16, and ARA-23) will be discontinued. Because of its proximity to the ARA-23 site, contaminated soil that comprises ARA-03 may very well be remediated by default, thereby negating the need for institutional controls. Institutional controls were never a requirement for PBF-16.

Remediation of all CERCLA sites at ARA will be completed by 2005; however, institutional controls to restrict access will still be required in 2035 at the following sites, unless a 5-year remedy effectiveness review determines that institutional controls are no longer required:

- ARA-06 ARA-II (Stationary Low-Power Reactor No. 1 Burial Ground)
- ARA-07 ARA-II (Seepage Pit to East) (ARA-720A)
- ARA-08 ARA-II (Seepage Pit to West) (ARA-720B)
- ARA-24 ARA-III (windblown soil)
- ARA-25 ARA-I (soil beneath ARA-626 Hot Cells)
- PBF-10 PBF (Reactor Area Evaporation Pond) (PBF-733)
- PBF-12 PBF SPERT-I (Leach Pond)
- PBF-13 PBF (Reactor Area Rubble Pit)

- PBF-21 PBF SPERT-III (Large Leach Pond)
- PBF-22 PBF SPERT-IV (Leach Pond) (PBF-758)
- PBF-26 PBF SPERT-IV (lake).

4.7.3 Risk Assessment Summary

Detailed risk assessment information is published in the *Waste Area Group 5 Operable Unit 5-12 Comprehensive Remedial Investigation/Feasibility Study* (Holdren et al. 1999) and in the *Remedial Investigation/Feasibility Study Report for Operable Units 5-05 and 6-01 (SL-1 and BORAX-1 Burial Grounds)* (Holdren, Filemyr, and Vetter 1995).

The following land-use assumptions were used in the development of the remedial action objectives for WAG 5 remediation:

- Institutional controls until 2095 will include current security controls, site access controls, radiological controls, and worker monitoring
- For 2095 and beyond, homes could be built anywhere within WAG 5, and a water supply well could be drilled next to the home.

Risk estimates for the 100-year future residential scenario and ecological risks were used to identify sites for remediation.

4.7.3.1 Human Health Risk Assessment. The *Waste Area Group 5 Operable Unit 5-12 Comprehensive Remedial Investigation/Feasibility Study* (Holdren et al. 1999) describes the assumptions, uncertainties, and conclusions of the human health risk assessment in detail. The following human exposure scenarios were analyzed in the OU-5-12 baseline risk assessment in the *Waste Area Group 5 Operable Unit 5-12 Comprehensive Remedial Investigation/Feasibility Study* (Holdren et al. 1999):

- A current occupational scenario that lasts for 25 years
- A future occupational scenario that starts in 100 years and lasts for 25 years
- A future residential exposure scenario that begins in 100 years and lasts for 30 years.

Future residents were assumed to construct 10-ft basements beneath their homes. Therefore, all contamination detected in the upper 10 ft of each site was evaluated for surface pathway exposures. The residential 10-ft intrusion scenario was evaluated for all sites, except those that do not have 10 ft of soil. Residential risks at these sites were calculated assuming that a future resident would excavate down to basalt and spread the excavated dirt around their home.

In general, only adult exposures were evaluated because of the very conservative assumptions that were incorporated in the baseline risk assessment calculations. The assumptions most likely caused the calculated risk results to overestimate actual risks, even to sensitive subpopulations such as children, that would result from exposure to the site contamination. The exception was the soil ingestion exposure route. Under this exposure route, 6 years of childhood soil ingestion and 24 years of adult soil ingestion were included in the contaminant intake calculation.

Groundwater pathway risks were estimated at 100 years in the future for the 100-year residential exposure scenario. Maximum groundwater risks for each potential COC within 10,000 years also were estimated.

The GWSCREEN results indicated that WAG 5 does not contain sources of contamination that have the potential to produce risk greater than 1 in 10,000 or an HQ greater than 1 for groundwater exposure pathways (e.g., groundwater ingestion). In addition, residential scenario cumulative risk estimates and hazard indices were less than 1 in 10,000 and 1, respectively, for the combined sources within WAG 5 for the air and groundwater exposure pathways.

4.7.3.2 Ecological Risk Assessment. Flora surrounding WAG 5 were determined using a vegetation map constructed for the INL using LANDSAT imagery and field measurements from vegetation plots. Fauna potentially existing in the WAG 5 area were identified primarily from a 1986 vertebrate survey performed on the INL and from data collected subsequent to the survey. No areas of critical habitat and no threatened and endangered or sensitive plant species have been recorded at or near the facilities. Four sensitive mammalian species potentially occur at or near the ARA or PBF. These include the pygmy rabbit, Townsend's western big-eared bat, the long-eared myotis, and the small-footed myotis. In July and August 1997, field surveys were conducted for individual sites of concern within ARA and PBF facilities. An onsite inspection was conducted, and each site of contamination was evaluated for habitat qualities and the potential to support INL threatened and endangered species or other species of concern. Each site was rated as high, medium, low, or none based on the positive habitat features and probability that the species of concern may use the site.

Ecological receptors can be exposed to contaminated media directly through ingestion of contaminated vegetation, water, and prey; incidental ingestion of soil; or physical contact or inhalation. Inhalation and physical contact, however, are considered to play minor roles in the exposure to surface contamination for WAG 5 and were not evaluated in the assessment. Contaminants in subsurface soil can be transported to ecological receptors by plant uptake and translocation by burrowing animals. Contamination at depths greater than 10 ft is considered inaccessible to ecological receptors because that depth generally is below the root zone of plant and the burrowing depth of ground-dwelling animals.

Insects and burrowing animals also can bring contaminated subsurface soil and buried waste to the surface. Once contaminated soil is brought close to the surface, transport and exposure scenarios for ecological receptors are the same as for surface soil. Inhalation and direct contact by burrowing animals are more important exposure routes for subsurface contamination than for surface contamination.

Four sites, ARA-01, ARA-12, ARA-25, and PBF-16, were found to pose potential risk to ecological receptors. These sites all had ecological HQs greater than 10. Because these sites are small, it was determined that it would be less expensive to remediate than to do further characterization. Three of the sites, ARA-01, ARA-12, and ARA-25, also exceeded human health risk thresholds.

Table 4-9. Contaminant concentrations and risk levels for sites under institutional control at the Waste Reduction Operations Complex/Power Burst Facility and Auxiliary Reactor Area.

Site Number	COCs	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (100 years)	Future Residential Risk (100 years)	Ecological Risk (HQ)	Remediation Status	ICs for >100 Years	Basis for ICs and Comments
ARA-01 (Chemical Evaporation Pond)	Arsenic	10 mg/kg (calculated residential[a])	11–25.8 mg/kg.	1 in 10,000	<1 in 10,000	2 in 10,000	No	In progress	No	Because arsenic poses an unacceptable risk to human health, site access has been restricted until remediation is implemented. Land-use controls will not be required after remediation if contaminated soil is removed and residual contaminant concentrations do not pose an unacceptable risk.
	Selenium	2.2 mg/kg (ecological)	24.8–27.7 mg/kg.	No	No	No	HQ = 2–300	In progress		Risk to ecological receptor HQs ranges from 2 to 300. Avian insectivores, avian omnivores, mammalian insectivores, and mammalian herbivores may be at risk.
	Thallium	4.3 mg/kg (ecological)	13.5–59.2 mg/kg.	No	No	No	HQ = 2–300	In progress		Risk to ecological receptor HQs ranges from 2 to 300. Avian omnivores and mammalian insectivores may be at risk. The bat species and pygmy rabbit, both classified by the State of Idaho as species of special concern, are also potentially at risk from exposure to thallium.
ARA-02 (Sanitary Waste System)	Lead	400 mg/kg (EPA level for residential use)	2.61 mg/kg.[b]	No	No	No	No	Complete	No	Remediation of the ARA-02 site was determined to be successful. There is no remaining risk from lead.
	Aroclor-1242	1 mg/kg (Toxic Substances Control Act level for unrestricted release)	0.05 mg/kg.[b]	No	No	No	No	Complete		No remaining risk.

Table 4-9. (continued).

Site Number	COCs	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (100 years)	Future Residential Risk (100 years)	Ecological Risk (HQ)	Remediation Status	ICs for >100 Years	Basis for ICs and Comments
	Radium-226	1.2 pCi/g (100-year residential)	0.18 pCi/g.[b]	No	No	No	No	Complete		No remaining risk.
	Cesium-137	8.5 pCi/g (100-year residential)	0.36 pCi/g in the excavation. A few areas of surficial contamination still remain.	No	No	No	No	Complete		Remediation of the ARA-02 site was determined to be successful. However, a few isolated locations have cesium-137 contamination above 23 pCi/g caused by windblown spread from ARA-23. These areas will be addressed during remediation of ARA-23, after which the need for continued ICs will be reevaluated.
	Uranium-235	6.2 pCi/g (100-year residential)	0.24 pCi/g.[b]	No	No	No	No	Complete		No remaining risk.
	Uranium-238	10.6 pCi/g (100-year residential)	0.38 pCi/g.[b]	No	No	No	No	Complete		No remaining risk.
ARA-03 (Lead Sheeting Pad)	Cesium-137	N/A	Not available.	5 in 100,000	5 in 1,000,000	2 in 100,000	No	No further action required	No	ICs are required to restrict use of the site to industrial until residual cesium-137 decays to levels acceptable for unrestricted use.
ARA-06 (SL-1 Reactor Burial Ground)	Radionuclides	N/A	Not available.	Not available	Not available	1 in 10	No	No further action required	Yes	Land-use controls are required to inhibit intrusion into the buried waste. It is estimated that the risk will diminish to 1 in 10,000 in approximately 400 years.
ARA-07 (ARA-II Seepage Pit East)	Cesium-137	N/A	13.8 pCi/g.	Not available	Not available	<1 in 10,000	No	No further action required	No	Residual cesium-137 contamination exists that warrants ICs. The controls consist of visible access restriction (signs) and prevention of unauthorized access (i.e., the INL security gate). The requirements for ICs will be reviewed every 5 years.

Table 4-9. (continued).

Site Number	COCs	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (100 years)	Future Residential Risk (100 years)	Ecological Risk (HQ)	Remediation Status	ICs for >100 Years	Basis for ICs and Comments
ARA-08 (ARA-II Seepage Pit West)	Cesium-137	N/A	9.1 pCi/g.	Not available	Not available	No	No	No further action required	No	Residual cesium-137 contamination exists that warrants ICs. The controls consist of visible access restriction (signs) and prevention of unauthorized access (i.e., the INL security gate). The requirements for ICs will be reviewed every 5 years.
ARA-12 (ARA-III Radiological Waste Leach Pond)	Silver-108m	0.75 pCi/g (100-year residential)	0.23–67.2 pCi/g.[a]	1 in 1,000	6 in 10,000	2 in 1,000	No	In progress	No	Because of the presence of silver-108m, which poses an unacceptable human health risk, site access has been restricted and ICs will be maintained until remediation is complete.
	Copper	220 mg/kg (ecological)	12.9–623 mg/kg.	No	No	No	HQ = 1–300	In progress		The HQs for copper range from 1 to 300 for avian insectivores and mammals including the pygmy rabbit and bats.
	Mercury	0.5 mg/kg (ecological)	0.24–1.4 mg/kg.	No	No	No	HQ = 1–90	In progress		The HQs for mercury range from 1 to 90 for plants and for avian herbivores and mammals, including the pygmy rabbit and bats.
	Selenium	2.2 mg/kg (ecological)	0.25–2.7 mg/kg.	No	No	No	HQ = 1–30	In progress		The HQs for selenium range from 1 to 30 for avian insectivores and mammals, including three bat species of special concern.
ARA-16 (ARA-I Radionuclide Tank)	Cesium-137	23 pCi/g (100-year residential)	<1.5 pCi/g at the basalt interface. A few areas with surficial contamination still remain.	<1 in 10,000	<1 in 10,000	<1 in 10,000	No	Complete	No	Remediation of the ARA-16 site was determined to be successful; however, a few isolated locations still have cesium-137 contamination above 23 pCi/g because of windblown spread from ARA-23. These areas will be addressed during remediation of ARA-23, after which the need for continued ICs will be reevaluated.

Table 4-9. (continued).

Site Number	COCs	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (100 years)	Future Residential Risk (100 years)	Ecological Risk (HQ)	Remediation Status	ICs for >100 Years	Basis for ICs and Comments
ARA-23 (Radiological Contaminated Soil around ARA-I and ARA-II)	Cesium-137	23 pCi/g (100-year residential)	0.27–2,140 pCi/g (average = 88.5 pCi/g).	2 in 10,000	7 in 100,000	5 in 10,000	No	In progress	No	Because cesium-137 poses risk to human health, site access has been restricted and ICs will be maintained until remediation is complete and ICs are discontinued in a 5-year review.
ARA-24 (ARA-III Windblown Soil)	Radionuclides	N/A	Not available.	<1 in 1,000,000	<1 in 1,000,000	<1 in 1,000,000	No	No further action required	Yes	A contaminated pipeline embedded in concrete 20 ft below grade remains. Land-use restrictions are needed to prohibit intrusion and potential exposure to radiologically contaminated material.
ARA-25 (Soil beneath ARA-626 Hot Cells)	Arsenic	5.8 mg/kg (100-year residential)	≤36 mg/kg.	No	No	No	No	Complete	Yes	ICs are required to prevent intrusion because of elevated contaminant levels remaining at the basalt interface.
	Cesium-137	23 pCi/g (100-year residential)	25.7–398.1 pCi/g.	No	No	No	No	Complete		ICs are required to prevent intrusion, because of elevated contaminant levels remaining at the basalt interface.
	Radium-226	1.2 pCi/g (100-year residential)	≤26.3 pCi/g.	No	No	No	No	Complete		ICs are required to prevent intrusion, because of elevated contaminant levels remaining at the basalt interface.
	Copper	220 mg/kg (ecological)	≤201 mg/kg.	No	No	No	No	Complete		No remaining risk.
	Lead	400 mg/kg (EPA level for residential use)	≤1,266 mg/kg.	No	No	No	No	Complete		ICs are required to prevent intrusion, because of elevated contaminant levels remaining at the basalt interface.
PBF-10 (Reactor Area Evaporation Pond)	Cesium-137 and Chromium	N/A	Not available.	N/A[c]	N/A[c]	2 in 100,000	No	Complete	No	ICs are maintained because the postremediation baseline risk to the 100-year future residential receptor is 2 in 100,000.

Table 4-9. (continued).

Site Number	COCs	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (100 years)	Future Residential Risk (100 years)	Ecological Risk (HQ)	Remediation Status	ICs for >100 Years	Basis for ICs and Comments
PBF-12 (SPERT-I Leach Pond)	Cesium-137	N/A	0.57–31.4 pCi/g.	No	No	2 in 100,000	No	No further action required	No	ICs are maintained because the postremediation baseline risk to the 100-year future residential receptor is 2 in 100,000.
PBF-13 (Reactor Area Rubble Pit)	Possible asbestos	N/A	Not available.	No	No	No	No	No further action required	Yes	The site possibly contains friable asbestos. ICs are maintained to prevent intrusion and potential exposure to friable asbestos. The site was covered with 10 ft of soil and riprap. Recommendations for appropriate land-use restrictions will accompany any land transfer.
PBF-21 (PBF SPERT-III Large Leach Pond)	Cesium-137	N/A	Not available.	N/A[c]	N/A[c]	1 in 100,000	No	No further action required	No	Because of the presence of residual contamination, the site is restricted to industrial land use. Contamination is covered by an 8-ft-thick layer of soil.
	Uranium-238	N/A	Not available.	N/A[c]	N/A[c]	2 in 1,000,000	No	No further action required		Because of the presence of residual contamination, the site is restricted to industrial land use. Contamination is covered by an 8-ft-thick layer of soil.
PBF-22 (PBF SPERT-IV Leach Pond)	Cesium-137	N/A	Not available.	9 in 1,000,000	No	3 in 1,000,000	No	No further action required	Yes	Because of the presence of residual contamination, the site is restricted to industrial land use.
	Arsenic	N/A	Not available.	Not available	Not available	2 in 10,000	No	No further action required		Because of the presence of residual contamination, the site is restricted to industrial land use.
PBF-26 (PBF SPERT-IV Lake)	All COCs	N/A	N/A.	1 in 10,000	4 in 100,000	3 in 10,000	No	No further action required	Yes	The site has been restricted to industrial land use because of the presence of residual contamination.
	Arsenic	N/A	Not available.	Not available	Not available	2 in 10,000	No	No further action required		The site has been restricted to industrial land use because of the presence of residual contamination.
	Polychlorinated biphenyls	N/A	<10 mg/kg.	Not available	Not available	7 in 100,000	No	No further action required		The site has been restricted to industrial land use because of the presence of residual contamination.

Table 4-9. (continued).

Site Number	COCs	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (100 years)	Future Residential Risk (100 years)	Ecological Risk (HQ)	Remediation Status	ICs for >100 Years	Basis for ICs and Comments
	Cesium-137	N/A	Not available.	7 in 100,000	Not available	6 in 100,000	No	No further action required		The site has been restricted to industrial land use because of the presence of residual contamination.
	Uranium-235	N/A	Not available.	Not available	Not available	3 in 100,000	No	No further action required		The site has been restricted to industrial land use because of the presence of residual contamination.
	Uranium-238	N/A	Not available.	Not available	Not available	3 in 1,000,000	No	No further action required		The site has been restricted to industrial land use because of the presence of residual contamination.

Sources of Information:

OU 5-12 ROD (DOE-ID 2000c)

Remedial Action Report for WAG 5, OU 5-12 Phase I Remedial Action; Sites ARA-02, ARA-16, ARA-25, and Inactive Waste System Sites ARA-07, ARA-08, ARA-13, and ARA-21 (Wells and Giles 2000)

Waste Area Group 5 Operable Unit 5-12 Comprehensive Remedial Investigation/Feasibility Study (Holdren et al. 1999)

Institutional Controls Status Report for the Power Burst Facility and Auxiliary Reactor Area, Operable Unit 5-12, for Fiscal Year 2003 (DOE-ID 2003f)

a. Arsenic is the only human health COC at ARA-01. Therefore, a remediation goal based on a 1 in 10,000 risk to the 100-year future resident for a single contaminant was calculated

b. Cs-137 was used as a marker and the concentrations of the other COCs were derived assuming the concentrations of the other COCs are present at the same ratio as the maximum concentrations provided in the ROD

c. Because the residual COCs are not in the upper 4 ft of soil, the current and future occupational scenarios are not applicable

COC = contaminant of concern
EPA = U.S. Environmental Protection Agency
HQ = hazard quotient
IC = institutional control
INL = Idaho National Laboratory
N/A = not applicable
PBF = Power Burst Facility

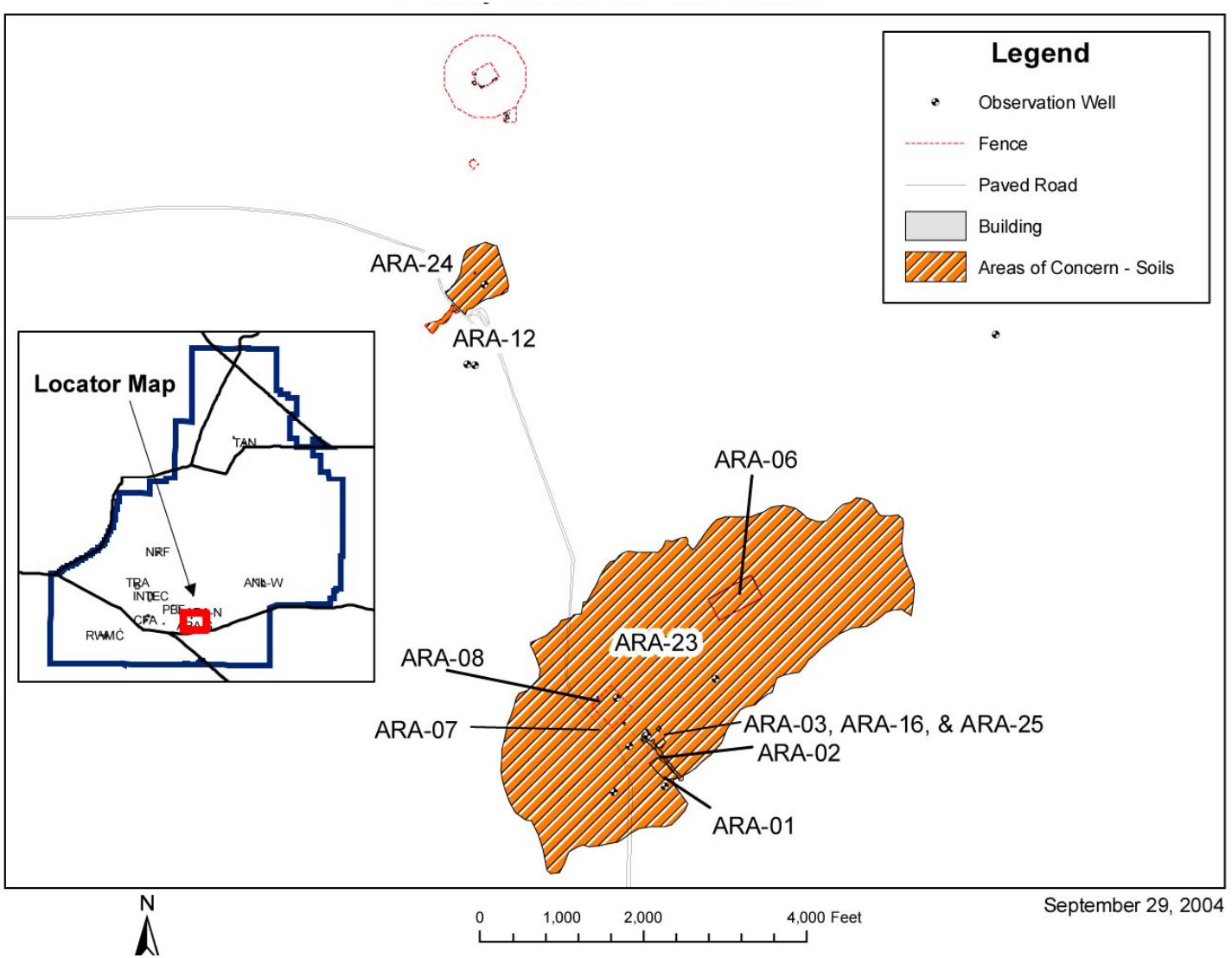


Figure 4-41. Auxiliary Reactor Area map—current state.

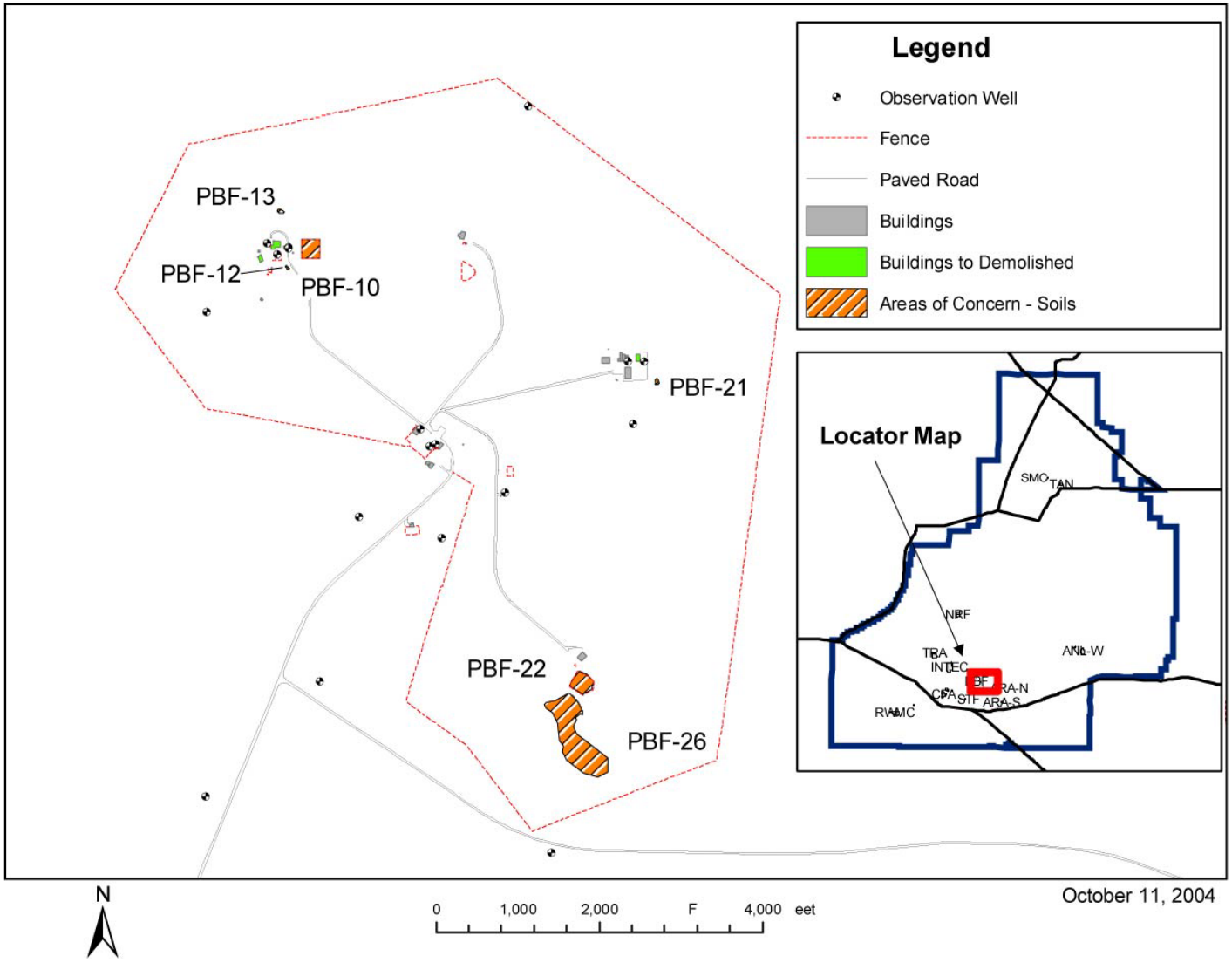


Figure 4-42. Waste Reduction Operations Complex/Power Burst Facility map—current state.

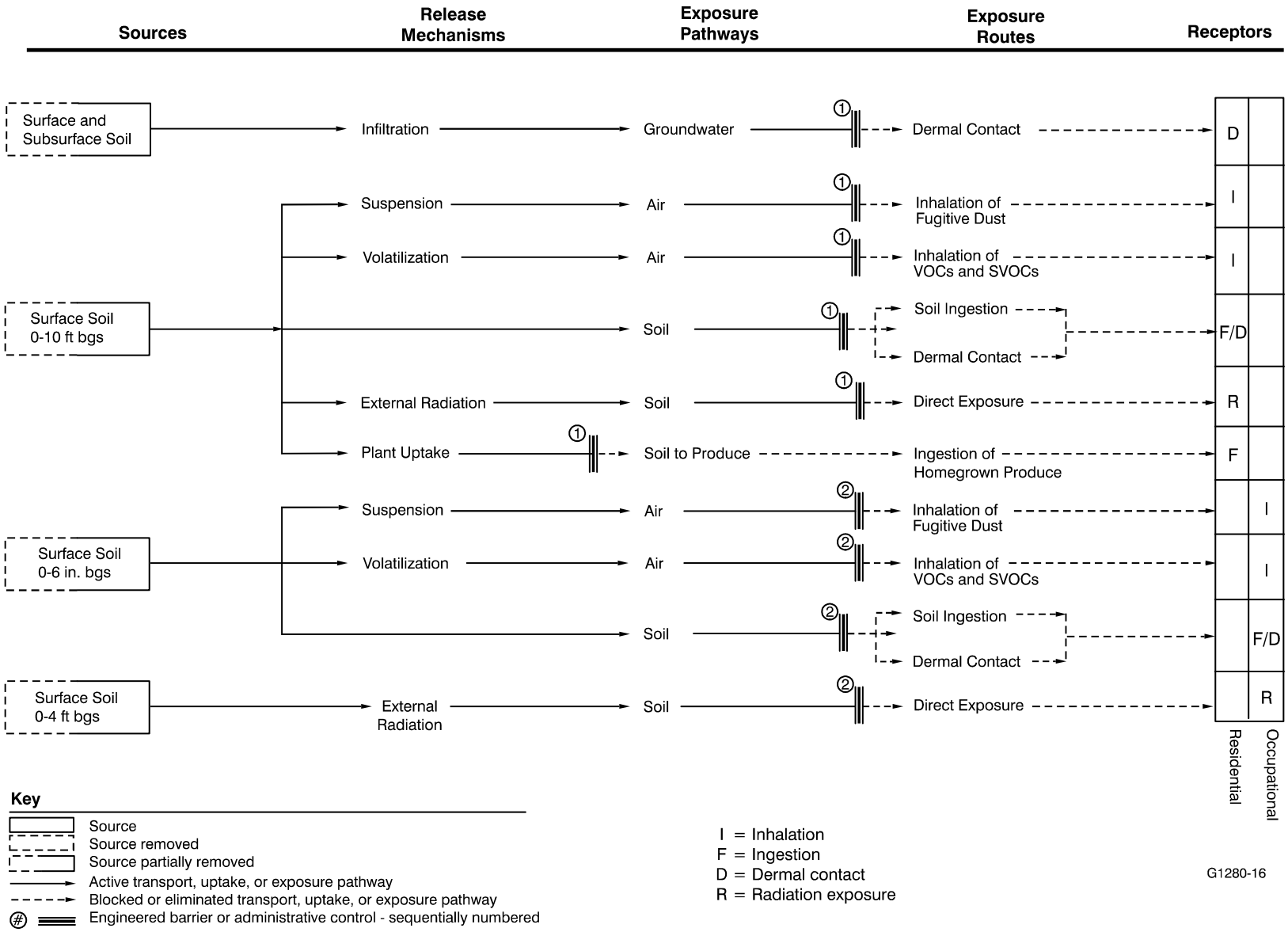
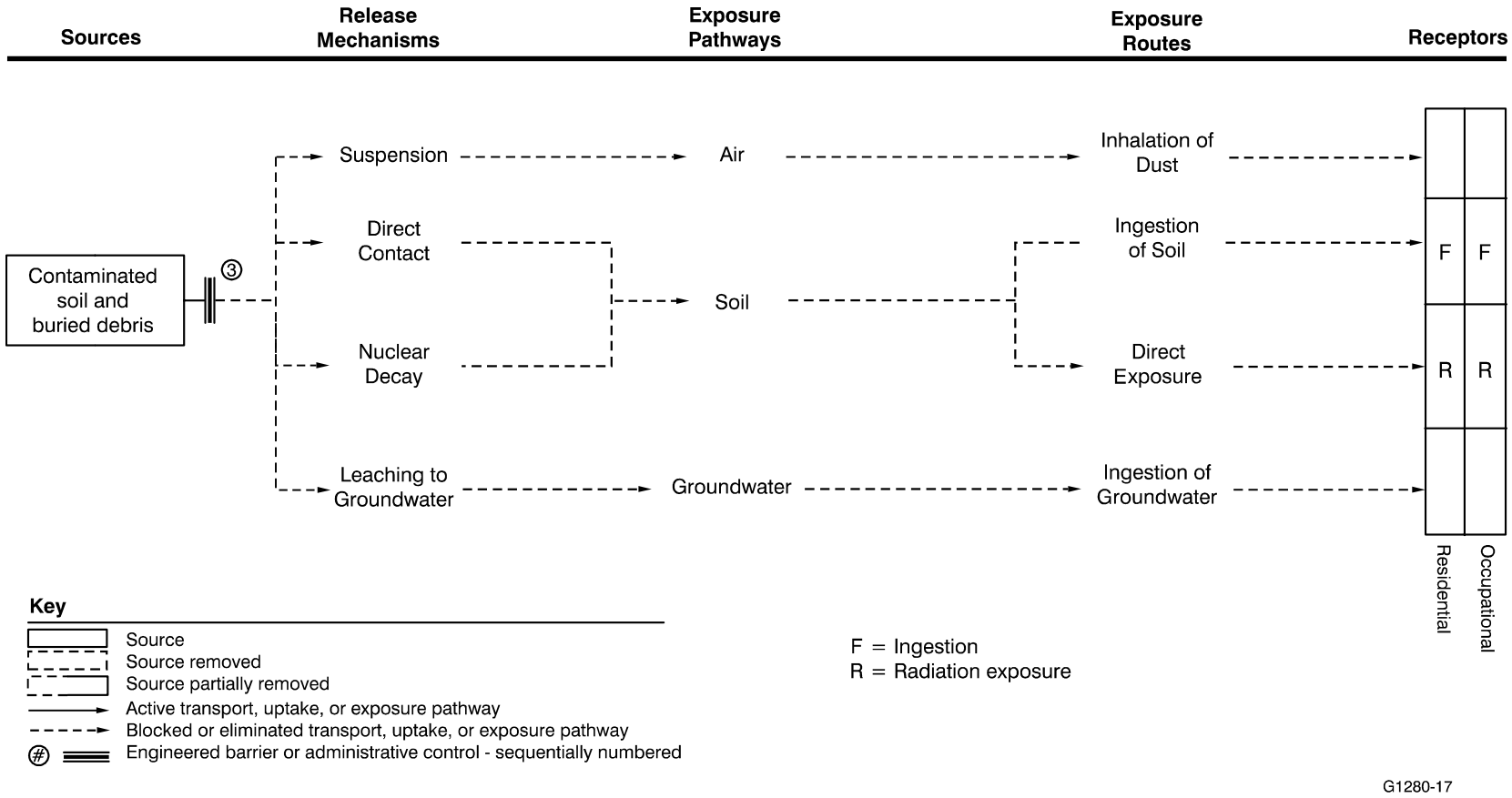


Figure 4-43. Waste Reduction Operations Complex/Power Burst Facility and Auxiliary Reactor Area conceptual site model—current state.



SVOC = semivolatile organic compound

Figure 4-43. (continued).

Narrative for Figure 4-43 Waste Reduction Operations Complex/Power Burst Facility and Auxiliary Reactor Area Conceptual Site Model—Current State

All remedial actions have been completed, except for sites ARA-01, ARA-12, and ARA-23. Remedial actions for these sites are under way. Remedial actions for all sites will be completed by the end of 2004. Site ARA-01 will be remediated to address human health risk from arsenic and potential risks to ecological receptors from exposure to selenium and thallium. Site ARA-12 will be remediated to address human health risks from silver-108m and cesium-137 and ecological risks from copper, mercury, and selenium in surface and subsurface soil. An area of elevated gamma activity to the southwest of the site also will be remediated. Site ARA-23, which includes the radiological contaminated soil around ARA-I and ARA-II and the remaining reactor foundation and the remaining underground utilities within the facility fences, will be remediated to address the human health risks from cesium-137.

Note: The OU 5-12 ROD (DOE-ID 2000c) concluded that WAG 5 does not contain sources of contamination that have the potential to produce risk greater than 1 in 10,000 or an HQ greater than 1 for groundwater exposure pathways (e.g., groundwater ingestion). In addition, residential scenario cumulative risk estimates and hazard indices were less than 1 in 10,000 and 1, respectively, for the combined sources within WAG 5 for the air and groundwater exposure pathways. Therefore, although these pathways are shown on the conceptual site model, they do not present a risk to human receptors.

Actions and Barriers:

The steps taken to mitigate or remove these hazards are as follows:

1. Institutional controls are in place at sites ARA-01, ARA-12, and ARA-23 until remediation is implemented as prescribed in the ROD. The selected remedial action for these sites is removal and on-Site disposal at the ICDF. The estimated volume of contaminated soil is 1,373,243 ft^3. Institutional controls also are maintained at 14 other sites that require no further action but where residual contamination still poses risk to human health (see Section 4.7.1).

   The entire INL Site has restricted access to prevent intrusion by the public. Visible access restrictions (warning signs) are in place at sites with institutional controls.

2. Workers are protected from direct exposure to radionuclide contamination through institutional controls. These controls include posting of signs at contaminated sites, radiological training, and work control processes used to identify hazards and mitigation measures for planned work activities.

3. For the SL-1 Reactor Burial Ground, containment by capping with an engineered long-term barrier provides overall protection of human health and the environment. Isolation both inhibits migration of contaminants from the burial ground and allows time for radioactive decay of the primary contributor to the overall risk (i.e., cesium-137 and progeny). The risk will diminish to 1 in 10,000 in approximately 400 years.

Failure Analysis:

The engineered cover is designed to maintain its effectiveness for at least 400 years with minimal maintenance. The cover was designed to provide sufficient shielding to reduce direct radiation exposure risks, resist erosion, resist biotic and human intrusion, and inhibit biotic transport of contaminants to the surface. Though the SL-1 type cover is designed to be maintenance free, cap integrity monitoring and periodic removal of undesirable vegetation and burrowing animals are performed as needed during the institutional control period.

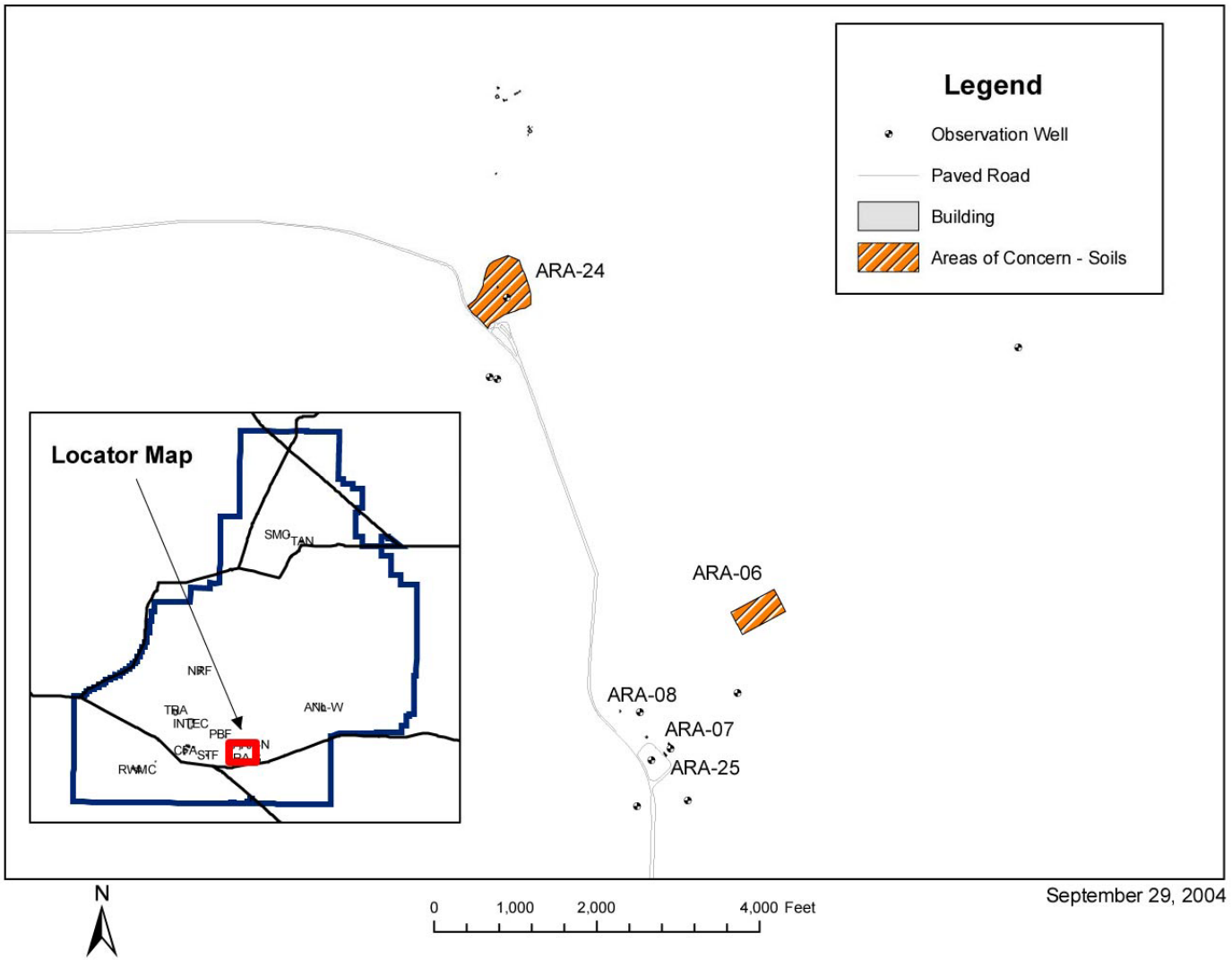


Figure 4-44. Auxiliary Reactor Area map—end state.

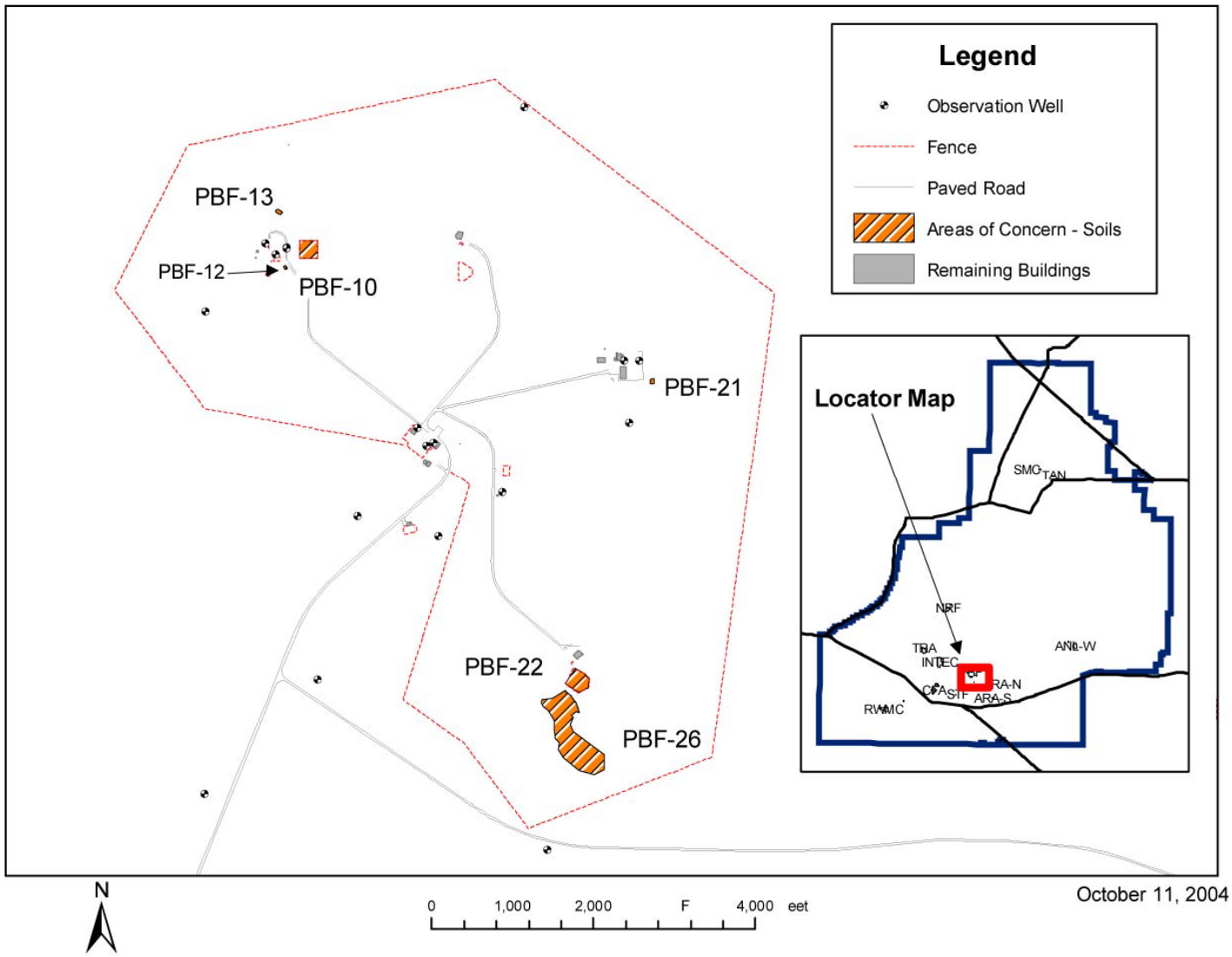


Figure 4-45. Waste Reduction Operations Complex/Power Burst Facility map—end state.

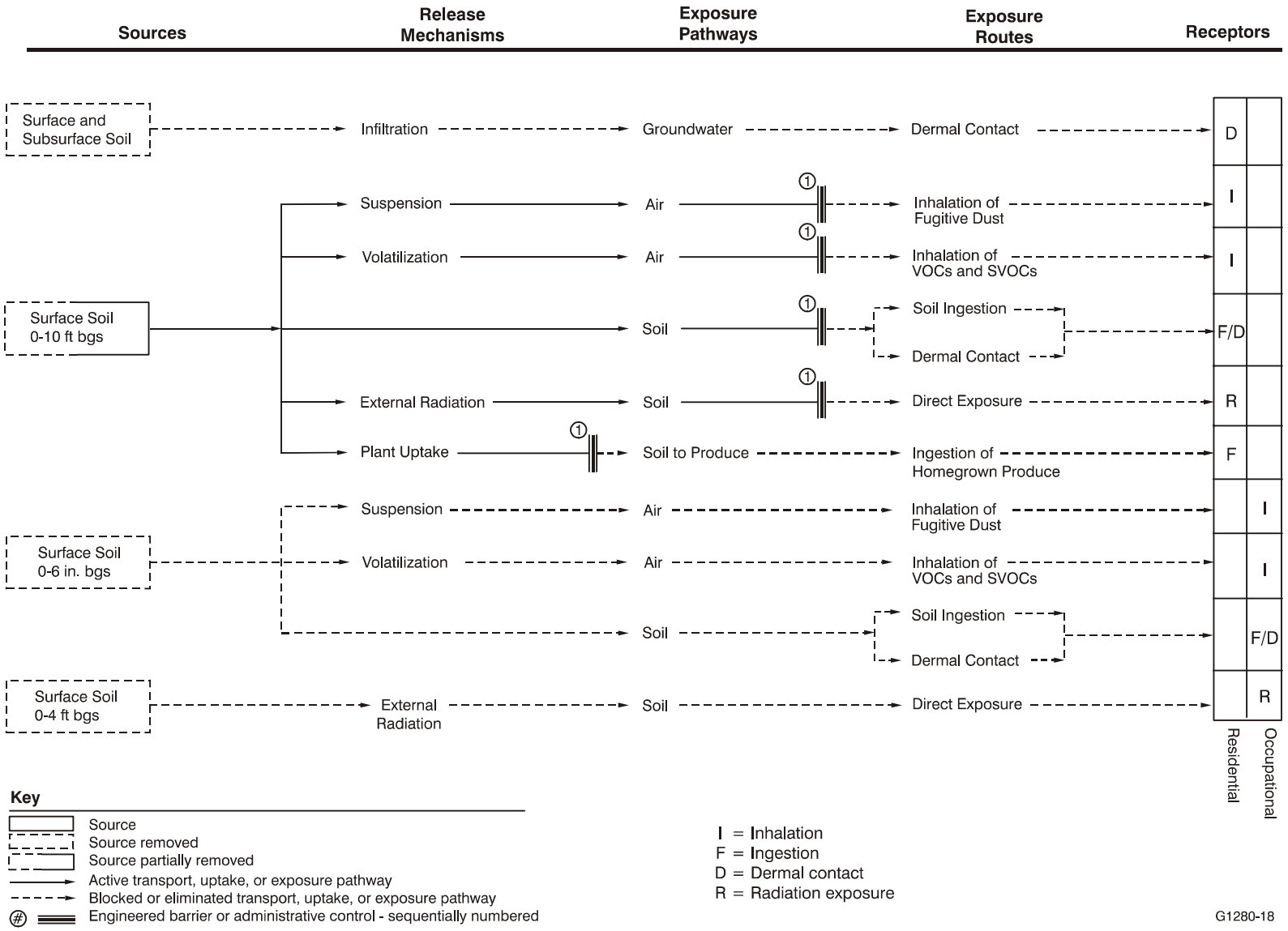
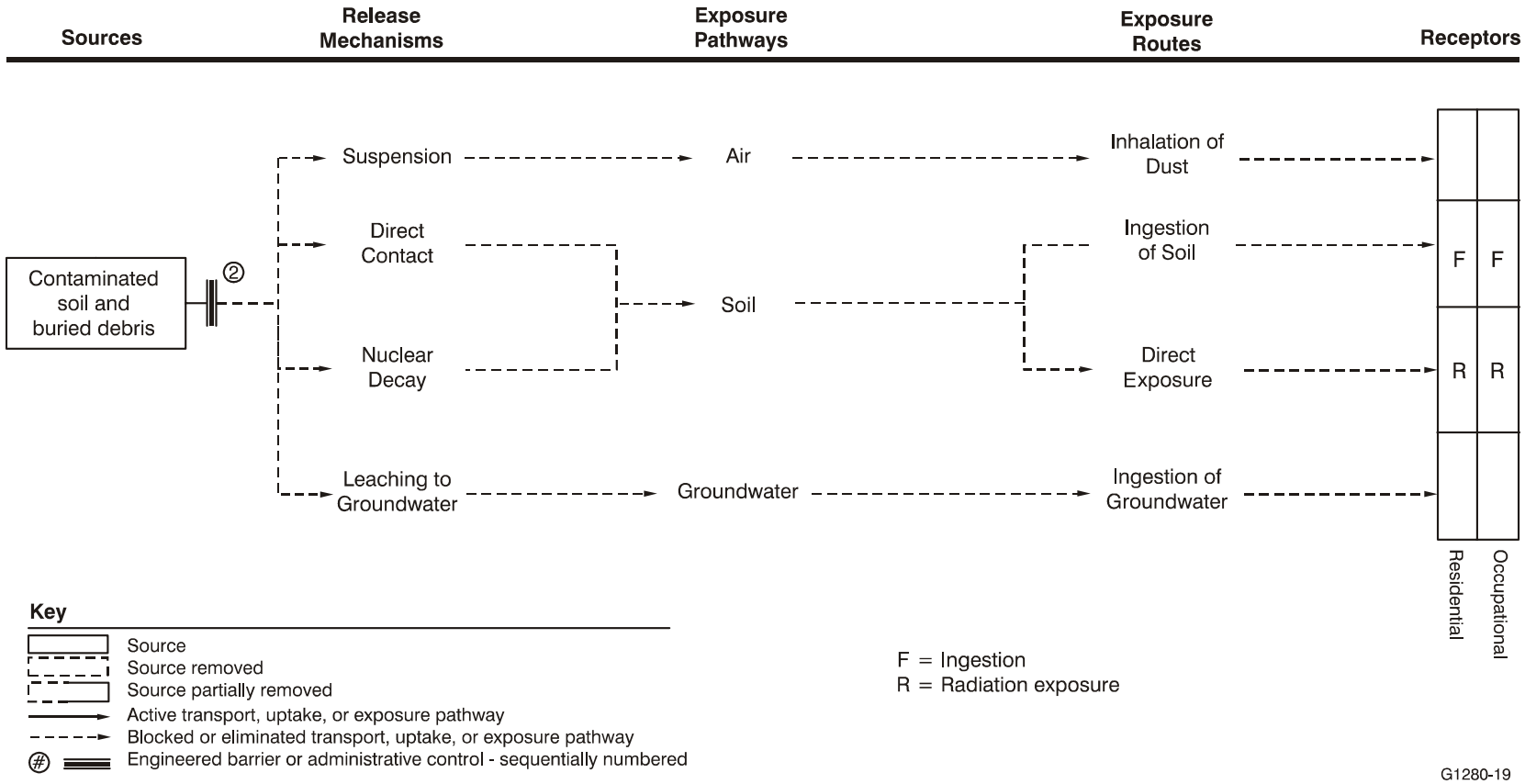


Figure 4-46. Waste Reduction Operations Complex/Power Burst Facility and Auxiliary Reactor Area conceptual site model—end state.



SVOC = semivolatile organic compound

Figure 4-46. (continued).

Narrative for Figure 4-46 Waste Reduction Operations Complex/Power Burst Facility and Auxiliary Reactor Area Conceptual Site Model—End State

Remediation of all sites will be completed by the end of 2004. Institutional controls at sites ARA-06, ARA-07, ARA-08, ARA-24, ARA-25, PBF-10, PBF-12, PBF-13, PBF-21, PBF-22, and PBF-26 will be required beyond 2035 because of continued radionuclide contamination, unless a 5-year remedy effectiveness review determines that institutional controls should not be maintained.

Note: The OU 5-12 ROD (DOE-ID 2000c) concluded that WAG 5 does not contain sources of contamination that have the potential to produce risk greater than 1 in 10,000 or an HQ greater than 1 for groundwater exposure pathways (e.g., groundwater ingestion). In addition, residential scenario cumulative risk estimates and hazard indices were less than 1 in 10,000 and 1, respectively, for the combined sources within WAG 5 for the air and groundwater exposure pathways. Therefore, although these pathways are shown on the conceptual site model, they do not present a risk to human receptors.

Actions and Barriers:

The steps taken to mitigate or remove these hazards are as follows:

1. The entire INL Site has restricted access to prevent intrusion by the public. These controls will continue as long as there is an active DOE mission at the site. Workers are protected through posting of signs at contaminated sites, by recording contaminated sites in the Site institutional controls database, and through the work control process used to identify hazards and mitigation measures for planned work activities. In the event that the DOE mission should end at some time in the future, property transfer requirements and deed restrictions would be required for some sites.

2. For the SL-1 Reactor Burial Ground, containment by capping with an engineered long-term barrier provides overall protection of human health and the environment. Isolation both inhibits migration of contaminants from the burial ground and allows time for radioactive decay of the primary contributor to the overall risk (i.e., cesium-137 and progeny). The risk diminishes to 1 in 10,000 in approximately 400 years.

Failure Analysis:

The engineered cover is designed to maintain its effectiveness for at least 400 years with minimal maintenance. The cover was designed to provide sufficient shielding to reduce direct radiation exposure risks, resist erosion, resist biotic and human intrusion, and inhibit biotic transport of contaminants to the surface. Though the SL-1 type cover is designed to be maintenance free, cap integrity monitoring and periodic removal of undesirable vegetation and burrowing animals are performed as needed during the institutional control period.